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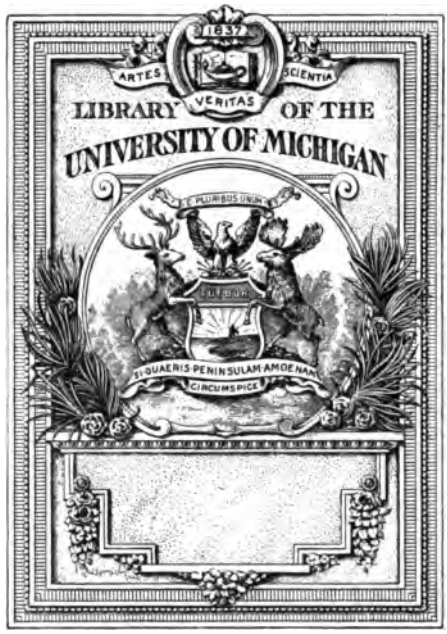
PROGRESS OF THE BEET-SUGAR INDUSTRY IN THE UNITED STATES IN 1907

DEPARTMENT OF AGRICULTURE

REPORT No. 88



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U. S. DEPARTMENT OF AGRICULTURE.

Report No. 86.

PROGRESS

OF THE

BEET-SUGAR INDUSTRY

IN

THE UNITED STATES

IN

1907.

WASHINGTON:
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1908.

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF PLANT INDUSTRY,
OFFICE OF THE CHIEF OF BUREAU,
Washington, D. C., May 1, 1908.

SIR: I transmit herewith the manuscript of the annual report on the Progress of the Beet-Sugar Industry in the United States in 1907. It consists of the report of the special agent, Mr. Charles F. Saylor, and a brief account of the studies and investigations pursued by members of the staff of this Bureau.

I recommend that this manuscript be published as Report No. 86 of this Department.

Respectfully,

B. T. GALLOWAY,
Chief of Bureau.

Hon. JAMES WILSON,
Secretary.

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PROGRESS OF THE BEET-SUGAR INDUSTRY IN THE UNITED STATES IN 1907.

REPORT OF THE SPECIAL AGENT,

CHARLES F. SAYLOR.

INTRODUCTION.

Owing largely to climatic conditions, results in the beet-sugar industry throughout the different States were not as uniform and not as satisfactory on an average in 1907 as in 1906. Sugar beets are not more influenced by varying conditions than any other crops, but being a comparatively new crop, results are more closely scrutinized by the public. As a matter of fact this crop has proven more reliablo and more capable of certain forecast than almost any other.

The outlook for extending the beet-sugar industry, considering all the circumstances, continues bright. There are many projects on foot for establishing new factories, but the effect of the financial stringency, characterizing the advent of the year of 1908, is nowhere more apparent than in this new field. On this account it does not seem probable that many factories will be installed in 1908.

COMBINATION OF INTERESTS.

The sugar business of the United States has consisted largely in the refining of imported raw sugar. The jobbers, wholesalers, and retailers have distributed the refined product to consumers. These refining interests have turned their attention to the beet sugar with a view to producing the raw and refined sugar from home-grown products. They, with the home manufacturers of sugar, are getting together—combining—to manufacture, refine, and dispose of the sugar required in this country to be made from beets and cane. The close of 1907 indicates that these investing and business interests are more united than ever in the manufacture, refining, and distribution of the home sugar production.

LAND SPECULATION AS A FACTOR IN DEVELOPING THE SUGAR INDUSTRY.

The arid and semiarid lands of the West for several years appear to have offered the chief field for developing the beet-sugar industry in the United States. For this reason it is often assumed that the

industry is becoming localized in the arid West. This is more apparent than real. The tillable lands of the valleys in the intermountain and coast States, as a rule, are well adapted to the sugar industry. For some time it has sought this locality, where it has been more readily and successfully established. But the causes leading to this are largely local, and, to some extent, temporary. The rapid progress of the beet-sugar industry in the West is largely due to the following causes: (1) Owing to natural conditions the available uses to which land could be put have been very limited, grazing being in fact the chief use; (2) their value ($1 to $5 per acre) has been based on their limited earning power as grazing land; (3) any new enterprise naturally looks to the speculative as well as the permanent phases of the investment.

Speculation has, indeed, had much to do with installing the beet-sugar industry, and it probably will have for some time to come. These cheap lands, when watered by irrigation and planted to fruit or utilized in any form of intensive agriculture, are capable of wonderful increase in values. Under natural conditions they may not have any considerable earning power, but with irrigation their value is enormously increased. It is well known that an available supply of water and a sugar factory offer all the opportunity and assurance needed to induce capital to build an irrigation ditch. Most factories built in this dry country of the West were established on account of the opportunities to develop certain tracts of land. Promoters reap the harvest which results from this large increase in land values. At the same time the factory is permanently equipped to do its work in a profitable manner.

Often a company develops a sugar-beet district, builds a large factory, opens up the irrigation ditches necessary, and invests the capital required to bring to the highest utility a large tract of land. Around some of these plants, large tracts of land are still the property of the plant. As beet growing develops, all other features of intensive farming develop proportionately. Lands formerly worth a few dollars per acre become permanent assets of the plant or the owners, worth $200 to $300 per acre. Such opportunities for land speculation do not exist in the older settled States such as Wisconsin, Ohio, and New York. It is largely the speculative possibilities that have taken the sugar industry to the West.

The greatest need of an arid new country is some industry like sugar manufacturing, which offers an incentive for the investment of capital. The sugar industry leads and encourages all others in this respect. It not only complements all kinds of agricultural production, but it combines all industrial effort. It absolutely necessitates the irrigation ditch. It is a guarantee of success to many other branches of industry. Its inauguration leads to the building of rail-

roads and trolley lines, the establishment of creameries and dairies, the development of stock breeding and feeding and poultry raising, the manufacture of alcohol, and other industries related in one way or another to the sugar industry.

The substantial lines of agricultural industry in the East are established, but the arid and semiarid lands brought under irrigation are virgin soil open to any use. It is easy to plan a new building, but to remodel an old one is difficult. This illustrates the real difference between installing sugar factories in the arid West and in well-developed agricultural districts of the East. For some time to come the sugar industry may grow faster in the West, but it costs less to produce beets in districts receiving moisture by rainfall than by irrigation. Rentals and land values are steadier in the East. The sugar industry with its associate features of development always influences these values. Eventually the sugar industry in the arid country will reach its speculative maximum. The cost of producing beets and the cost of fuel and transportation are lower in the East, and markets are more accessible. In time these advantages will so exert themselves that the East and the West will be producing sugar more in proportion to the lands available for the purpose.

MANUFACTURE OF DENATURED ALCOHOL.

I desire at this time to call attention to the production of alcohol as one of the industries related to the beet-sugar industry. Recent legislation promoting the production of denatured alcohol to be used in the arts and sciences will redound to the benefit of the sugar industry. It will take time in this country to develop this new phase of alcohol production. Sources, means, and methods must be worked out. The waste molasses furnishes an excellent raw product for use in its manufacture. Experiments indicate that the starches and sugars contained in the pulp may possibly make it useful for the same purpose.

In Germany, France, and England, where alcohol production has developed to a considerable extent, the raw material is largely from the field crops, principally potatoes and beets.

IMPROVEMENTS IN FACTORY CONSTRUCTION AND EQUIPMENT.

The character of new factory construction and the class of machinery installed are matters worthy of special comment. My observation during the past year in this respect especially enforces the importance of the improvement. Originally factories were built cheaply and less substantially than they should have been. Some of them were of poor construction, with the inner framework of wood and hence not fireproof. Some of the first factories utilized buildings formerly constructed for other purposes, remodeling them, but never making them entirely satisfactory.

With hardly an exception the factories established during the last two years have buildings of the finest masonry, steel-framed, with cement floors, and practically fireproof.

In some of the older factories second-grade machinery was used, often second-hand or imported machinery of old types and patterns, requiring large expense to remodel for effective work. Those of recent construction are made according to the most modern patterns and of best materials. In these new plants most of the machinery was made in this country.

HOW THE INDUSTRY GROWS.

In the pioneer work of establishing the beet-sugar industry, those who undertook the location and construction of factories could have no guides in the selection of location except the study of conditions and results of experimental work in growing beets. As a natural result, some mistakes were made. This method of deciding on a location has now been almost entirely superseded by a more natural and logical process of growth. Now a new factory is nearly always located in a district in which beets have been grown on a considerable scale for an older factory. It often happens that a factory in securing acreage for a sufficient supply of beets has to reach out into one or more districts that are somewhat remote, thus developing beet growing over a large territory. When, later on, the acreage devoted to beet growing near the factory increases, the management may find it impracticable longer to handle the beets grown in some outlying district, and it furnishes both the demand and the opportunity for the establishment of a new factory in an area where sugar-beet production is a demonstrated success. The company which originally developed beet growing in this district may embrace the opportunity thus opened by building an additional factory. If it does not, some other company already in the field may undertake to establish a plant, or an entirely new company may be organized for this purpose. This process of growth involves but a fraction of the hazards and difficulties involved in the pioneer method, and the results are almost invariably satisfactory.

DISTINGUISHING FEATURES OF THE BEET-SUGAR INDUSTRY.

In the northern half of the country the beet-sugar industry is now practically distributed from the Atlantic to the Pacific. It has developed many substantial features. To an extent it has intrenched itself in public confidence as a permanent industry worthy of attention and consideration. It is no longer an experiment. Its establishment seems permanent, its development healthful, and its future assured. These conditions have been brought about through many influences. Considering the industry's future in this country and the factors favor-

able to its development compared with those opposed, I am disposed to be optimistic.

Throughout the world's competition, in the production and marketing of sugar, we find arrayed the two rivals—the cane-sugar industry and the beet-sugar industry. The contest is between two phases of agriculture which are diametrically opposed in nearly every respect—geographical location, moral, social, and civic ideals, and community of interests. It is a contest between the domination of capital unhampered by organized labor or social barriers on the one hand, and on the other a branch of industry in which human rights and privileges must receive high consideration. In the Tropics, cheap labor and bountiful production oppose the more complicated enterprises and expensive conditions of the Temperate Zone, where industry is dominated by a spirit and policy which places the general welfare above every other consideration. To build the sugar industry in this country required intelligence, energy, sacrifices, and the indomitable spirit of progress. No one influence is entitled to all the credit. The Department of Agriculture, with its great scientific bureaus, has given this industry standing and power. This Department has been ably assisted by the State experiment stations, which have in a large measure worked out the culture problems through experiments and investigations, developing facts and disseminating knowledge. The public press, both general and agricultural, have kept abreast with this work and greatly aided in disseminating information and educating the public. All these influences have tended to stimulate organization and active work on the part of farmers, business men, and capitalists.

EDUCATING AND DEVELOPING INFLUENCE OF THE BEET-SUGAR INDUSTRY.

In a sugar-factory district the inexperienced growers are not left to their own resources in producing this new crop. They are under contract with a sugar factory to produce beets, and this contract covers the methods that shall be employed. In seeing that these methods are followed the responsibilities of the factory management are as great as those of the farmer. Unless the factory can receive beets that are at least up to the minimum requirements in sugar content and purity, it can hardly hope to succeed. One of the chief responsibilities of such a plant rests upon the agriculturist. The contracts with the farmer make it incumbent on them to produce beets in accordance with certain stipulations under the direction of a representative of the factory. The men chosen as such representatives are experienced agriculturists, in some degree scientists, thoroughly acquainted with the best methods of agriculture, the action of the soil, and the management of men. They have a corps of assist-

ants constantly moving about among the beet growers, seeing that they do the necessary work to produce beets that will meet requirements of the factory. This agricultural superintendent and his representatives are in constant touch with the beet growers, advising them with reference to all the details of preparing the land, cultivating the plants, and harvesting the crop. While their instruction is specific with reference to beets, they are constantly advising as to the production of all crops. If a piece of ground shows poor results from lack of drainage, its improvement in this respect is advised, and so with reference to fertility, or any other feature. These advisers, representing the sugar factory, fully understand that a plant costing hundreds of thousands is no temporary affair. They appreciate that the relations of the plant with the agricultural community will last longer than one year. While they are striving to bring the best results from a crop of beets planted each year, they are also endeavoring to best prepare the land and the farming community to serve the interests which they represent for a long period of time. They know that a tract of land should not grow beets more than a year or two, after which it must go into other crops in a cycle of rotation, eventually to produce beets again. They look forward to the planting of additional lands each year, and for this reason they must advise in regard to drainage, rotation, fertilization, the selection of the best seed, and everything that has to do with the success of all the crops of the farming community.

There is no one fact more constantly in the mind of the management of the sugar factory than that it must take the initiative in improving the agricultural practice of the community and assume responsibility for the results of its experts. This work requires patience and energy, and involves expense. The management appreciates that the longer the factory has been established the more its difficulties will diminish and the less its advice will be needed.

One of the things that has impressed me most in studying the general tendencies of the beet-sugar industry is the wonderful influence it is having on all that class of farmers, tenants, and laborers who may properly come under the term of beet growers. It is generally improving the productiveness of the soil, and the one feature of greatest importance is the tendency to methodical production of all crops.

In a district undertaking the cultivation of this crop, its needs must necessarily affect the whole field of agriculture. To adapt a field to the production of beets requires time, patience, expense, and intelligence. The ultimate results depend on several things: (1) The natural adaptability of the soil; (2) its manipulation for a series of years; (3) the rotation adopted; (4) the farmer who applies his labor and intelligence at the proper time and in the right way to achieve results.

Under the system of agriculture in this country, it is customary to assume that farming is a simple process. Anyone reared on a farm, under the ordinary acceptation of the term, is called a farmer. Thousands of such people eke out an existence. They subsist, defray their expenses, and close their careers, leaving the world about as they found it, without having improved it or their own conditions. This class has lived in vain. They have not helped their calling or added anything to the world with all its opportunities.

In agriculture in this country we have been busy pioneering, opening new settlements, and have never been really competitors. We have been doing things in a haphazard way. The world calls for our productions, and they are sold. We have exerted our energies and paid our debts. At the close of the year we know that we have lived, we are still alive, and have enough to live on until the next crop. Profit and loss are things not under consideration. Declining years, waning powers, have no terrors. We have simply drifted with the tide. But now we have reached a new era. The productive lands of this country are nearly all settled. Every acre must necessarily become a competitor of every other in this broad land. Rentals, values, and profits must be measured by the sales book and cost of production. We must be more methodical and must look more to the future.

A sugar factory not only intensifies the farming but makes the land support a larger population. In sugar-beet districts, the number of inhabitants deriving their living from farming is increased many fold. The factory becomes the nucleus of settlement. The growth of the community leads to the establishment of graded schools and brings the improvements enjoyed by older communities. Railroads are established, trolley lines are built, churches are organized, and free mail delivery is installed. This brings the daily press and the telegraph and telephone. It also brings together and organizes the people of the district for social and business cooperation. In such a community we find the people organized for serious consideration of everything that has to do with public roads, schools, churches, and social, business, and intellectual progress.

COSTS AND PROFITS OF SUGAR-BEET GROWING.

As elsewhere stated in this report, the usual estimate of cost for growing beets under rain conditions is $30 per acre; under irrigation, $40. The usual price paid for the hand work, when done under contract, is $20 per acre for the season. The actual cost of production naturally varies a good deal with conditions. Under exceptionally favorable conditions, beets may be grown and harvested for somewhat less than $30 per acre; but if the season is bad, and labor scarce and dear, the cost may considerably exceed $40 per acre. For the

years 1901–1906, the lowest annual yield of sugar beets per acre for the whole country was 8½ tons in 1903; the highest annual average was 11¼ tons in 1906; and the mean average for the six years was 9½ tons per acre. These average yields are for the total acreage harvested, and do not include any abandoned acreage. The price paid for sugar beets delivered at the factory varies somewhat, but the usual price is $5 per ton, and this may safely be accepted as an average price. The average yield of 9½ tons per acre, at an average price of $5 per ton, gives $47.50 as the average gross return per acre of sugar beets for the entire country for the six years. If we assume that $35 is the average cost of production per acre, $12.50 will represent the net return per acre of sugar beets. This net return represents rent of land, interest on capital, and profits.

That it is possible to secure net returns vastly greater than the average just given has been repeatedly demonstrated by results over large areas. It is not uncommon for individual growers to secure gross returns of $75 to more than $100 per acre.

In former reports I have given detailed statements of operations in beet growing in cases where accounts were kept, and the actual costs and returns could be shown. The following are similar reports which I have secured during the past year.

The following report by E. C. Amann, cashier of the Crawford County Bank, and secretary of the Beet Growers' Association, Prairie du Chien, Wis., shows what live men can do, when properly organized, in investigating conditions as regards the sugar industry, at the same time securing substantial returns:

In regard to the sugar beets which were grown here in 1906, I am inclosing you a report made by the local Beet Growers' Association. We rented 50 acres of land and hired a manager and hired all the work. As you will see 15 of us put in $60 each and when the books were closed we returned to the stockholders the amount of the investment and gave each stockholder a check for $86.26. The report which I inclose you herewith gives the items in detail.

Our soil is sandy and the beets seem to grow very rapidly and show a high percentage of sugar. There is no question in my mind but what, if we were assured that a sugar factory would be located here, we could secure contracts for 3,000 to 4,000 acres. We have a large territory to draw from and one particular advantage of our soil is that after a heavy rain the farmer can work his field the next day owing to the sand absorbing the water. This is a very strong point, especially when beets are weeded and thinned. By giving the beets the proper attention at the proper time, there is no necessity of letting the weeds get ahead of the beets.

We rented a 50-acre field which we planted to beets. We figured that we had about 48 acres of beets, 2 acres being deducted to allow for land covered by buildings, and for land not used. Fifteen of the business men joined this association and each agreed to make payments up to $100 to cover the expense. After payments had been made up to $60, the sugar company made us a loan of $10 an acre and the remittances we received from the company gave us sufficient working capital so that it was not necessary to have the stockholders make any more payments. As you will see from this statement, we returned the $60 to each stockholder, and have a net profit of $1,293.98, besides hav-

ing tools worth $55.40. We, of course, think growing sugar beets is like "getting money from home."

We were told that our 50 acres was the largest field of beets in the State; and as we hired all the work done, besides paying a superintendent, we consider the earnings as showing what can be done in raising sugar beets. The percentage of sugar this year was not as high as the average for 1905. We expect to grow 100 acres next year.

Very truly,

BEET GROWERS' ASSOCIATION,
E. C. AMANN, *Secretary*.

RECEIPTS.

Paid in by stockholders, $60 each	$900.00
May 21, 1906, lumber sold (farm shed removed)	10.00
October 6, 1906, loan from beet-sugar company	[a] 500.00
December 26, 1906, remitted by company for beets	1,573.52
December 26, 1906, applied by company to payment for seed	112.50
December 26, 1906, applied by company to payment of freight	182.22
February 6, 1907, balance remitted by company for beets	1,176.02
Total receipts	4,454.26

EXPENDITURES.

Rent		400.00
Tools:		
Lifting forks	$1.50	
Knives	7.90	
Beet lifters	7.00	
Two plows, one beet lifter	21.50	
Weeders	17.50	
		55.40
Plowing and seeding		141.60
Cultivating beets		130.70
Thinning beets		315.16
Topping and pulling		409.85
Hauling		272.15
Superintendent		240.70
Seed		112.50
Freight		182.22
Payment made by stockholders returned		900.00
Total expenditures		3,160.28
Cash on hand—net profits		1,293.98

RECAPITULATION.

Total tonnage from 48 acres	tons	728.5
Average yield per acre	tons	15.1
Total deduction for tare	tons	39.0
Average content of sugar	per cent	13.2
Total gross returns for beets		$3,544.26
Gross returns per acre		73.85
Expense per acre		46.90
Net profit per acre		26.95
Total net profit		1,293.93
Profit for each stockholder		86.26
Cost of tools remaining on hand		55.40

[a] This item was afterwards deducted from the value of the beets delivered to the factory, and may therefore be considered as an advance payment for beets.

The Detroit (Mich.) Farmer of March 9, 1907, publishes a carefully itemized statement of the cost and profits of growing sugar beets:

Another successful season for beet growers in the Saginaw Valley is past and in view of two good seasons in succession growers are making contracts for increased acreage next spring. Below are a few figures secured by Midland County growers last season.

Mr. J. E. Sayres harvested 78½ tons of beets from 5 acres (15.7 tons per acre) and sold them at a flat rate of $5 per ton delivered at the weigh station in Midland. He kept a careful itemized account of the expenses of growing the crop, a summary of which follows:

Costs and results of growing 5 acres of beets in Michigan.

Gross returns, 78½ tons of beets, at $5		$392.44
Plowing and preparation of land	$10.50	
Seed	7.50	
Drilling	3.50	
Cleaning with horse weeder	1.50	
Thinning and hand weeding	29.60	
Cultivation to July 27	19.75	
Pulling and topping	40.00	
Hauling to car and cellar	49.40	
Hauling from cellar to car	15.00	
Total cost		176.75
Net returns		215.69
Net per acre		43.14

Mr. Sayres also charges his account with $6 per acre for rent of land; this leaves him $37.14, which is practically all clear profits. The extra $15 for hauling from cellar to car resulted from car shortage at hauling time. Mr. Sayres has been extremely careful in keeping his accounts and is well satisfied with the results.

The Montpelier (Vt.) Argus, of August 7, 1907, contains the following:

In Boulder County, near Denver, in 1906, 71,800 tons of beets were grown, averaging 15 to 17 tons to the acre. The total cost of growing an acre of sugar beets has been itemized as follows by an authority on that subject, Mr. F. D. Coburn, secretary of Kansas State board of agriculture: Plowing, $1; seed, 20 pounds, $2; planting, 50 cents; bunching and thinning, $6; hoeing and cultivating, $10; harvesting and topping, $8.50; interest on land, irrigation, hauling, and general charges, $9.50; total, $37.50. The net profit on 17 tons to the acre at $5 a ton is, therefore, $47.50. One grower reported a net profit of $85.50 an acre in 1906.

USE AND VALUE OF BY-PRODUCTS

The by-products which result from the growing of sugar beets and the manufacture of sugar therefrom are the tops and leaves, the pulp of the beets after the sugar has been extracted, the refuse molasses, and the unmarketable beets. All these are valuable food for farm animals.

TOPS AND LEAVES.

The tops and leaves are that part of the beet crop left in the fields when the beets are prepared for delivery to the factory. After the *beet is taken* out of the ground, a portion of the top carrying the

leaves is cut off. Often this refuse is allowed to cure on the ground and is plowed under. It has considerable value as a fertilizer. If the plans of the farmer contemplate the building up of the soil in some other manner, the tops and leaves may be used as stock food. In many places the stock is turned in on harvested beet fields and allowed to eat the refuse as it lies on the ground. On other farms, this refuse is carefully gathered, brought to the barn and stored, and fed to the stock as needed. The best use to be made of this refuse depends upon circumstances, but whatever the use, its value must not be lost sight of.

SUGAR-BEET PULP.

To the farmer the pulp is one of the most important by-products of the sugar factory. After the beets are delivered to the factory, cleaned, and sliced, the sugar is extracted from them. The residue is called the pulp.

The beets are cut up into long slices or strips about the size of a lead pencil. These slices, called cossettes, are not mashed or squeezed, their sugar content being simply dissolved out by the action of hot water. After this is accomplished, they are immediately removed to the dump, or silo. To the factory this is refuse to be disposed of. Often it occupies needed room and its removal entails expense. In many such cases it is given away. This is often the case with a new factory. In other older factory districts, or in those where stock interests are largely developed, it is sold for a nominal sum, the price depending upon the demand. When pulp is sold, it usually brings from 10 cents to $1 a ton, depending on the circumstances.

Many tests have been conducted in this country by State experiment stations and extensive feeders to ascertain the actual value of pulp as compared with other stock foods. This value depends largely upon the purposes of feeding. Estimates of the value vary from $1.50 to $4 per ton. Beet pulp has much hygienic value, as, being a succulent feed, it promotes digestion. It also takes the place of other rough feed. Experiments indicate that, when combined with other foods, it increases their food value.

The use of pulp for stock feeding has an important bearing on the future of the sugar industry. When a factory with ordinary capacity consumes 50,000 tons of beets, it turns out about 25,000 tons of pulp. It makes a vast difference whether this shall be thrown away—disposed of at an actual expense—or sold at so much per ton and removed by the buyer. Its importance will be more strongly emphasized when our farmers come to appreciate that it has an actual value of twice or three times the highest cost figure mentioned.

In most of the older countries of Europe the pulp is all consumed. Every pound is utilized with profit to both the consumer and seller.

In Europe pulp is considered of such importance that it is specially prepared by drying for general distribution and sale. The wet pulp coming from the sugar factory generally carries about 90 per cent of water. It is put through a process of drying in a special kiln, after which it is baled or sacked and shipped to all parts of the country. Everyone owning an animal uses it. We must in the end do the same in this country to utilize its value. Several of the earlier factories built in this country have since installed drying plants to prepare this stock feed, and some of the later ones have included such plants.

On account of its bulk and the cost of transporting its useless water content, the market for wet pulp must necessarily be confined to the immediate vicinity of the sugar factory. Dry pulp can be shipped like other dry feeds to all parts of the country.

While a number of factories in this country are now preparing dried pulp for general distribution, most factories supply only wet pulp.

A farmer can practice economy by delivering a load of beets to the factory and taking home a load of pulp. It is a product that is very easily stored and kept. Often farmers build special silos to receive it, though this is not necessary, as the pulp is not harmed by freezing. It may simply be piled in the open. If it is put in a conical pile, it will shed rain. In this condition it will keep two or three years. Freezing, rainfall, and hot weather seem to have very little deteriorating effect. But it deserves better care.

MOLASSES.

When the sugar has been dissolved from the pulp the solution contains much of the original impurities of the beet. In the process of sugar making it becomes necessary to eliminate the impurities, and some of the sugar goes with them. After all the sugar has been secured that can be extracted by ordinary methods we still have a refuse known as molasses. This refuse is an astringent mass made up of some sugar and the impurities and wastes. Analysis shows that it is from 45 to 49 per cent sugar, the rest being water, different salts originally in the beets, and other matter introduced in the extraction of the sugar.

During the campaign a sugar factory will turn out a considerable quantity of this molasses. Much study has been given to the use of this waste product. It contains much that is of commercial value, and by proper manipulation can be used as raw material for manufacture into valuable products, such as stock food, shoe blacking, glue, alcohol, fertilizers, etc. In Europe it is commonly used in the manufacture of alcohol, and a beginning along the same line has been made in this country, notably in Michigan.

We are just beginning to utilize the by-products of the sugar industry in profitable manufacturing. Until we shall have attained the

full development of this feature we must utilize in a more or less crude way the available materials.

Much of the molasses of Europe is mixed with the pulp before it goes through the drying process, and the result is a very desirable food for stock. On account of its salts, the molasses is too much of a laxative and also too astringent in taste to be fed alone; but, mixed with a large amount of pulp and then dried in kilns, it is very palatable and nutritious.

SUGAR BEETS FOR STOCK FOOD.

Under the contract the factory makes with a beet grower he must grow beets which come up to a certain standard of quality—usually 12 per cent of sugar with a purity of 80. When the beets are delivered he may be "docked" on account of beets not reaching this standard. This does not often occur, but sometimes it does. In such cases the crop of beets is not a loss. They are still valuable for stock food on his farm. Docking at a sugar factory is very rare and affects but a very small percentage of the total crop grown. When his beets are refused the farmer may store and feed them to his stock. For this purpose they are worth almost as much as for delivery to the sugar factory. It has been demonstrated time and time again by experiment stations of this country that there is no more valuable root crop for stock than sugar beets. It is not uncommon for stock feeders to stop farmers on the road with beets for a factory and pay the same price for use in feeding. Thus the farmer gets the same price with a short delivery.

In growing sugar beets for stock food it is not necessary to give the same care as in producing for the sugar factory. A farmer can usually grow twice the tonnage of stock beets as he can for factory use. Many farmers growing beets for the factories also grow a large tonnage of beets for their stock. This tendency is growing all the time. Farmers of this country are too much inclined to feed corn exclusively on account of its fattening qualities. Animals fattened on a ration which includes roots and other succulent feed yield carcasses that bring the highest price on the block.

Beets are easily stored in cellars, caves, or pits. They can be sliced and mixed with ground feeds and fed in the raw state or cooked with different grains in the preparation of slops and mashes for all classes of animals.

STOCK FEEDING.

One of the main advantages incident to the beet-sugar industry is its benefit to stock breeding and feeding. I have insisted on this throughout my reports and feel warranted in emphasizing it. Probably there is no other fact more certain than that this industry has had more influence in extending and developing the stock interests

of the country than any other. Especially is this true in the inter-mountain States, where the sugar industry has been developed faster.

A few years ago the stock interests of the West were confined mainly to grazing. While this western country still possesses much of its grazing facilities, having a great amount of land adapted to nothing else, the sugar industry with its pulp, molasses, beets, and beet tops, has revolutionized the stock business. The sugar factory has brought transportation facilities, the drainage ditch, labor, and other utilities. Through crop rotation it has stimulated the growing of other crops, such as alfalfa, barley, spelt, rye, etc., which can be fed with the pulp. Thus the stock grower has a balanced ration, not only for breeding and rearing stock, but for fattening and for producing milk, butter, and cheese. Under such conditions the "range horse" is becoming a thing of the past. The range remains simply one of the factors in a system for producing standard horses for all classes of work and use.

A trip through the sugar districts of Colorado, a State now possessing 16 sugar factories, all of comparatively recent date, will demonstrate this great transformation. The same can be observed in Utah, Idaho, Montana, and California. Around most of these factories thousands of sheep and cattle are fed annually, and dairying is rapidly developing. The old ranches are installing new buildings and equipment for breeding, raising, and finishing animals for the market. Much of the stock now produced on the range is brought into these places, fed on the ration produced at home, and shipped to eastern markets, in competition with the corn-fed stock of Iowa, Illinois, Indiana, and Ohio.

THE LABOR PROBLEM AND THE BEET-SUGAR INDUSTRY.

The labor problem is one of the most difficult in general agriculture in this country. There is not a place in the United States devoted to agriculture, whether the crops be general or special, where this question is not one of vital importance. The development of factories and mines and the demands of commerce have tended, on account of higher wages and greater opportunities, to attract the labor away from the farm, and there has been a steady movement of population toward the cities. Throughout my report I have insisted that the beet-sugar industry tends to counteract and correct this tendency. A sugar factory is an organized institution requiring large capital, but it must be located in a district where its raw material is produced. Unlike many other factory enterprises, it is not dependent upon the conditions and advantages of a large city. Many sugar factories are built in small villages. At the same time, a plant of this kind, involving a capitalization of $350,000 to $1,500,000, must *necessarily deal with labor* problems, the same as a steel mill, or some

other industrial enterprise found in the large cities of the country. It is the first requisite of every sugar factory to see that sufficient laborers are secured for growing the beets, and for doing the work of the factory. Agents qualified for this work are immediately put into the field to secure these laborers. They keep informed concerning the immigration of laborers from foreign countries, and carefully investigate the labor supplies of large cities. One of the first things that will be noticed upon the establishment of a sugar factory in an agricultural district is the influx of labor from varying sources. It is necessary to reiterate these facts, in order to counteract an idea which seems prevalent in the public mind, viz, that the labor problem offers such an obstacle as to thwart the success of a sugar factory in a farming district where labor is scarce. When a new factory is under consideration for a district, the farmer says: "I can not possibly secure enough help to do the work I now have on the farm. What can I do if I sign a contract to grow an intensive crop like sugar beets, thereby very much increasing the amount of labor required on my farm?" The reply to such a statement is that the sugar factory will solve this difficulty. To the ordinary farmer this answer seems paradoxical, but it is perfectly logical. In watching the development of conditions around every sugar factory now in operation in the United States, I have yet to find a case where the advent of the sugar factory has not attracted labor, not only for growing beets, but for all kinds of farm work.

In some districts where sugar factories have been established, factory agents go to the cities and hire large numbers of school children between the ages of 9 and 21. These are usually employed during the school vacation. They are quick and well adapted to certain lines of work in growing beets, such as weeding, bunching, and thinning during the growing season, and topping and piling when the crop is harvested. In addition to the school boys and girls, every city affords a large supply of laborers perfectly adapted, whether by former experience or sufficient intelligence, to do the work of growing the beets. Many of these laborers—Russians, Germans, French, Austrians, Hungarians, Portuguese, etc.—are immigrants from Europe with more or less experience in beet culture. Most foreigners have had some training in the rural districts in the countries from which they come. These countries, as a rule, have smaller farms, and must necessarily cultivate them more intensively. If they have not grown beets, they may be familiar with gardening and truck farming, and therefore adapted to the work of growing beets.

Every season sees more and more laborers trained for work in the beet fields. As the industry grows the supply increases, and keeps more nearly even with requirements than in other lines of agriculture.

It requires from 120 to 150 days to produce the beets and deliver them to the sugar factory. The sugar factory will see to it that its beet fields and factory are supplied with laborers. Throughout the beet-growing season laborers will devote many days to other lines of work for the farmers in the district. They are always available for this purpose after the harvest, so that a farmer growing sugar beets is not only put in a position to get help for beet farming, but also has a more available supply of labor for all other work on his farm.

I have closely observed the movement of these laborers in the spring from the larger cities to the beet fields throughout the United States. It is as constant and regular as the movement of the wild fowl from the north to the south. I have seen the morning trains carrying out of the city carload after carload of young boys and girls to work in the beet fields. There is no doubt that the sugar factory stimulates the labor supply of its territory. As an evidence of this fact, I offer a few clippings from the press. The Beet Sugar Gazette, of Chicago, May 6, 1907, speaking of laborers going to Fort Dodge, Iowa, where about 200 acres of beets were grown for the factory at Waverly, says:

The Fort Dodge Chronicle reports that a number of experienced sugar-beet growers from Nebraska have arrived and will be put to work on the experimental acreage at Fort Dodge.

The Hastings (Nebr.) Tribune, May 2, 1907, notes the large movement of laborers to the beet fields:

Several Russian-Germans left yesterday and to-day for various beet-growing sections. The major number went to Colorado, but a few were destined to the sugar-beet fields of Kansas and Michigan.

Three special trains carrying beet workers from Lincoln, Omaha, and other eastern towns, were taken west by the Burlington yesterday afternoon. The regular passenger trains also carried a large number of persons bound for the beet fields.

Last night three carloads of workers from this city were taken to Grand Island, from which place they were taken west by the Union Pacific.

It is estimated that 500 persons go annually from Hastings to work in the beet fields. They return late in the fall, some of them as late as December.

The Denver (Colo.) Republican of November 29, 1907, shows the movement of these laborers on their return after the season's work.

Denver and Rio Grande train No. 4, which arrived from the west late last night, had on board about 500 laborers who were returning to their homes in Nebraska from the beet fields near Grand Junction. Each spring these foreign laborers are taken to the beet districts and distributed among the different farmers to be used in the raising of the beet crop.

It is customary in the beet districts to erect temporary barracks or houses to accommodate these laborers during the growing season. These summer quarters for the field laborers may be substantial tents or rough wooden barracks. Throughout the beet districts the

laborers are usually composed of families consisting of father and mother and from three to ten children. It is the custom for the head of the family to contract to do the hand work on the beet farms at a certain price per acre, usually $20 to $22. This labor generally covers the work of bunching and thinning, hoeing, and the hand work connected with the harvesting of the beets.

While for a year or two these laborers may migrate back and forth from a certain locality to the beet fields in which they are working, each year sees more and more of them permanently settled in the vicinity in which the beets are grown. During the summer months they engage in beet growing, and during the other months they engage in other lines of labor connected with agricultural and other industrial occupations. An extract from the Port Huron (Mich.) Times of May 12, 1907, indicates how this takes place:

> Lansing business men have under consideration a plan of colonization of the foreigners who annually visit the vicinity to work in the sugar-beet fields. It is proposed to purchase the lands to be sold in tracts of perhaps 5 acres to the men as an inducement for them to locate permanently there.

As showing the results secured by foreign laborers in a factory district, I quote from the Topeka (Kans.) Capital of May 17, 1907:

> Word has been received in North Topeka from a number of the Russians who have left here during the last few weeks for Garden City, where they have been employed to work in the sugar-beet fields until the crop has been harvested in the fall.
>
> The Russians are being paid an average of about $2 a day for ten hours' labor, while families often contract to cultivate and take care of several acres for a stipulated amount. * * * Several of the persons who have accepted employment in that section this season were employed there last year and returned with more than $100 each and often as much as $200. More than 100 left North Topeka to work near Garden City this summer and others are expected to go in the near future.

The Pueblo (Colo.) Chieftain of March 27, 1907, says:

> We have a proposition from a colony of Japanese to do all the hand work—i. e., thinning, hoeing, and topping—in growing sugar beets for the season of 1907 at $22 an acre flat. They want from 500 to 15,000 acres.

The principal and most difficult work in the beet fields is that accomplished by the hand laborer. Granting that a farmer has at his command sufficient laborers to do this hand work, he is usually prepared through his regular farm help—comprising himself, his sons and his hired hands—to do that part of the work which requires the use of a team. Growing beets very much reduces the team work on the farm, although all the preliminary work of preparing the ground must be done with a team.

The actual time the laborers should devote to growing beets is, to an extent, problematical. The beginning depends largely upon the opening of the season. Planting should be neither hurried nor delayed. Everything depends upon the conditions. The field selected for growing beets should be kept in readiness. This is work that

devolves upon the farmer. When the time arrives the seed should be planted, whether weather conditions indicate an early or late season. The work of seeding is usually accomplished with implements designed for the purpose, but sometimes with small-grain seeders equipped for this work.

Whether the laborers are working by the day or under contract at so much per acre, their work begins after the seed is planted. The beets are often harrowed before they are up and two or three times thereafter. The hand laborer has to deal entirely with keeping out the grass and weeds with a hoe, bunching and thinning, and whatever hand cultivation may be necessary. After the beets are matured and ready for harvest he is required to cut off the tops with a knife and place the beets in piles for delivery to the factory. The division of the work between hand labor and team labor varies with conditions.

LABOR-SAVING IMPLEMENTS AND DEVICES.

Although the beet-sugar industry is new in this country, many improvements, both in methods and machinery, have resulted from American experience and ingenuity.

In the beginning of beet growing in this country we were necessarily compelled to employ the implements and methods in use in older countries. Many of these are well adapted to our use, though it may take us half a century to accustom ourselves to the methods and implements of culture developed through long experience in other countries. At the same time, the American, being progressive, is studying the improvement of these methods and implements.

BEET HARVESTERS.

The harvesting of beets makes a considerable item in the cost of producing the crop. After the beets are grown, they are usually extracted from the soil by means of a long narrow plow with a device for either cutting off or breaking loose the beets and elevating them to some extent. There are several methods of accomplishing this. The idea is to loosen the beets and leave them where the laborer can pick them up, cleave off the tops, and place them in piles ready for delivery to the factory. These implements are called beet pullers. It is readily seen that beet harvesting in this way consists in three different stages of work: (1) Loosening the beets; (2) picking up the loosened beets, cleaving the tops, and removing the dirt; and (3) placing the beets in wagons for delivery to the factory. American inventors are working on a machine designed to perform all three of these things in one operation. At the present time there is a dozen or more different devices adapted to this work. Every year sees better results. Many of these machines will work nicely in certain soils, but

must be improved in order to be adapted to all soils. When a practical machine of this kind is produced we will have done considerable to lower the cost of producing beets. One of the difficulties of harvesting is securing the necessary labor; the more work that can be done by machinery, the more progress we will have made in solving the labor problem and reducing the cost of the work.

TRACTION PLOWS.

The plowing of the ground is usually accomplished with an ordinary stirring plow. It is possible for a man and three good horses to plow from 2 to 3 acres per day. In some districts I note the introduction of a traction plow. The engines used can propel from 12 to 16 gangs and turn over 30 to 50 acres of land per day. They are especially adapted for use on large tracts of ground that are smooth and level. Their especial advantage to the sugar-beet industry lies in the fact that they accomplish a great deal of work in a short time. Sometimes an engine is stationed at either end of the field, so as to draw the plow in either direction by means of cable attachments. In other cases a traction engine moves across the field and drags the gang plows behind it. These traction engines are further used for conveying beets to the factory, drawing from the beet fields a train of wagons attached to each other, loaded with beets. For the purposes indicated, traction engines are destined to play an important part in the future of the beet-sugar industry.

OTHER IMPLEMENTS.

In the eleven years that I have been a close observer of the beet-sugar industry rapid progress has been made in the improvement of all implements having to do with the planting and cultivation of sugar beets. Machines have been designed to sow the seed and at the same time to deposit the commercial fertilizer. We have special wagons, saving time and expense in delivering the beets to the factory. We have special dumps built in the country on the side tracks of the railroads to which the farmers may deliver their beets and have them automatically dumped into cars. If delivered to the factory by wagons, they may be automatically dumped into bins, thus saving time and relieving the farmers of all the hand work of throwing the beets into bins with shovels. Not all beets are delivered to the cars and bins at the present time automatically, but many of them are, and the plans of nearly all new factories now include such conveniences. Some factories which do not have automatic dumps have an arrangement by which beets are taken out of wagons in nets and hoisted to the bins or cars by the use of a crane.

SUGAR-BEET CULTURE.

In my previous reports I have outlined with more or less fullness the general principles underlying beet culture and the methods most successfully employed in growing beets. Since each year sees many new growers entering the field, and my earlier reports are no longer available for distribution, I think it proper to repeat here some of the essentials of sugar-beet culture. It should be remarked also, as an added reason for again presenting this subject, that the methods employed in beet growing are constantly improving as experience points the way to better results. In fact, improved implements and methods of culture are the basis on which the future success of the industry depends.

THE BEET GROWER.

The success of the beet-sugar industry in this country requires definite habits and fixed purposes on the part of the growers. Changeable men with haphazard methods will not succeed with the beet crop. They had better confine their activities to other lines of production. A beet grower must have a clear and definite knowledge of his business. He must have perseverance and the habit of sticking to a line of action once adopted. The culture of this crop must enter into his farming plans for a series of years.

He should study the crop, its culture, and everything connected with it. He should first learn the general facts and principles involved. Having mastered these, he should become an investigator on his own account. He should be a constant observer of the work done and the results secured in his vicinity. He should study the soil on his own farm. While this advice is good for any farmer, it is especially good for the beet grower, for with the beet crop everything depends on intelligent, well-directed action.

If the beet grower is a tenant, it is to his interest to secure a long lease of the ground he tills in order that he may plan his crop rotation and have a deeper interest in the proper treatment of the soil. If the tenant is a farmer of the right sort, long tenancy is to the interest of the landowner as well. Though the soil be ever so well adapted and prepared, to yield best results it must continue for a considerable period in the hands of an experienced, industrious farmer. Extended experience in beet growing tends to give the grower the best ideals of cultivation, fertilization, and crop rotation. Each year he is better equipped to do the work—is a better farmer in all respects.

Studying intensive farming from the standpoint of the beet grower demonstrates that his best interests demand a systematic plan governing his whole work. The beet grower but partly comprehends his resources, if he does not secure all his advantages.

He may rent a farm for a year or two to grow beets, sell them to a sugar factory, and move on to another farm next year; but he is only a partial beneficiary of his business. To gain the highest reward of his calling, his plans should cover a series of years. He should have in mind not only the profits of beet growing, but the accruing benefits of his industry in the improvement of the land and the knowledge and experience he acquires.

The beet-growing farmer should aim to raise the things necessary for the sustenance of his family—milk, butter, eggs, meat, vegetables, grain, etc. His farming should be well balanced as well as systematic.

Except in so far as he voluntarily signs a contract to grow beets for a factory under the counsel and direction of a factory agriculturist, the farmer who becomes a beet grower surrenders none of his independence. At most he has only a little capital invested in special implements, and in many cases no investment of this kind is required. When his contract expires he is entirely at liberty to devote his land to other uses if he prefers to do so. Sugar beets are a cash crop, and the grower does not have to hunt a market. He need not worry about a possible "slump" in the market about harvest time, because the price he is to receive is fixed before he plants the beet seed. If, at the very worst, anything should happen to prevent the delivery of his beets to the factory, he can feed his crop to his farm animals and derive from them a benefit almost, if not quite, as great as if he had sold them for sugar making. In fact the beet grower is more completely "master of the situation" than the farmer engaged in almost any other line of production.

SELECTION OF LAND FOR BEET GROWING.

One of the matters of prime importance with those who contemplate building a beet-sugar factory is the selection of a district having soil adapted to beet culture. But this is not a problem for the beet grower to settle, except so far as he may see fit to engage in preliminary experiments designed to test the soil and climatic conditions. When the factory has been established and the farmer has contracted to grow the beets, the farmer must face the problem in soil selection, and a good deal depends on how he solves it. If he selects a poor or unsuitable plat of ground, he is likely to meet with poor success, and as a result may become discouraged and perhaps permanently prejudiced against beet growing. The prospective grower should select for his first beet crop his best land, considering not only character of soil but conditions as regards tilth and freedom from weeds. The soils should also be well drained. The farmer should bear in mind that the sugar-beet crop is far more expensive to grow than ordinary field crops. The usual

estimate of cost for growing and harvesting beets under rain conditions is $30 per acre; under irrigation, $40 per acre. It will therefore take a yield of 6 to 8 tons merely to pay expenses, while another ton per acre will only give him a fair rental for his land. In order to get good profits he must secure a comparatively large tonnage, and in order to make his crop acceptable to the factory he must grow beets of good quality as regards sugar content and purity. These considerations should guide the farmer in selecting the ground for his beet crop.

The sugar beet is an intensive crop and hence should be planted only on rich, well-cultivated land. It is not a reclamation crop. On account of the thorough and expensive cultivation needed, it should never be made a first crop on new ground or freshly broken sod.

PREPARATION OF THE SEED BED.

In the culture of the sugar beet the land is plowed deeper than for most other crops. If the preceding crop is removed in time, as in the case of small grain, the land should be plowed deep in the fall, and should then be stirred again in the spring. Where beets follow a corn crop which has been gathered from the stalk, the cornstalks must be removed. Then in the spring, after the ground has partially thawed, a disk harrow should be run over the field to cut the stubs and roots to pieces as much as possible, and a hayrake may be used to rake off the loosened stubs and any other trash. It is important to have the ground as clean as possible.

While deep plowing for sugar beets is the rule, care must be taken not to turn up too much new soil in a single year. The depth may be increased year after year until a depth of 10 or 12 inches has been reached. In a new district in 1906, 1,000 acres were planted to beets for the first time. The farmers were advised to plow deep, and most of them did so, many turning over 10 or 11 inches. The advice given these farmers was good in a general way, but bringing to the surface 5 or 6 inches of soil that had never been turned up before was too radical a step. Better results would have been secured if this new soil had been turned up an inch at a time during several years. In 1906, however, a good crop of beets was secured on this deep-plowed ground. But in 1907 corn, potatoes, and other crops did poorly in comparison. Many farmers got the impression that the beet crop had exhausted the soil.

After the ground has been stirred in the spring the soil should be put in a perfectly mellow condition. All clods should be pulverized. The harrow is the principal implement for this work, but it is sometimes advisable to use a roller or a float to crush the clods and then to follow with the harrow.

PLANTING THE SEED.

The beet seed should be planted in thoroughly pulverized soil which is sufficiently moist to germinate the seed. In rain districts planting should follow the spring rains. In irrigation districts the grower should apply water to prepare the soil for planting. From 10 to 20 pounds of seed should be used per acre.

The seed may be planted with a seeder specially designed for the purpose, or a grain seeder may be so adjusted as to perform the work in a satisfactory manner.

The following excellent suggestions appeared in the columns of the Bay City (Mich.) Tribune of May 4, 1907:

> Before attempting to sow seed great care should be taken to see that the land is in the best possible condition. See that your seed bed is firm and well pulverized, and that you have at least 3 inches of a loose soil on top. Do not sow your seed until the ground is warm enough to germinate it, as you will get much better results by getting a quick, thrifty germination than by allowing the seed to lie in the ground a long time before germinating.
>
> Do not plant your seed more than 1 inch deep. Poor stands and light tonnage always result from too deep planting. Get your rows as straight as possible, which will be a great help in cultivating.
>
> Use plenty of seed to the acre. We would recommend 20 pounds on 20-inch rows. Do not hurry your drilling. Take time enough to see that all your spouts are feeding so that each row will have a full stand of beets. Drill across at right angles to the way the field was plowed.

It is fair to state that there are some hazards in beet growing. The tender stage of a beet plant is the first two or three weeks after it comes through the ground. An early killing frost may destroy it; a beating rain may crust the ground, making its ultimate recovery difficult; continuous rains may promote a heavy growth of weeds and grass, the removal of which would require so much labor and expense as to be impracticable. In extreme cases it may be necessary to stir the ground again and replant, which is not so bad as a total loss, which often happens with other crops. As it requires only one hundred days or a little more to mature a beet crop, there is considerable range for the planting season. In the Mississippi Valley and the Eastern States beets may be planted from April 1 to June 15. Similar conditions in this respect exist in the intermountain and coast States. Replanting the crop is nearly always possible.

BUNCHING AND THINNING.

Beets should be thinned before or soon after the fourth leaf of the plant appears. This work should be done promptly and effectually. The beet seed-ball contains from one to six germs, each one of which may produce a plant. In their growth the plants from a single seed-ball may intertwine with each other. The sooner the surplus plants

are removed, the better for the plant that is to remain. This work can not be done without disturbing the rootlets of the plant that is left. If the work of thinning is neglected and plants acquire considerable size, the remaining plant will droop, be retarded in its growth, and require two or three weeks to recuperate. With a smaller plant this will not occur.

In order to secure a stand of beets from 10 to 20 pounds of seed per acre is used. Most of the resulting plants are superfluous. The first step in thinning is known as "blocking or bunching." This is done with a hand hoe. One stroke of this implement takes out all the beets in the row for a space of 8 to 10 inches. The distance between the bunches which are left should depend on the width between the rows and other circumstances. Thinning is completed by extracting from each bunch all the plants except one. It takes a quick eye and hand to complete this operation, but it is soon learned by practice. A workman, usually one who is young and active, crawls along the row on his hands and knees, removing the surplus plants in the bunches. He should remove any growing weeds or grass around the remaining plant and press down the loose dirt. This completes the work of bunching and thinning. Much depends upon having this work done at the proper time and in the right way.

Much investigation and experimentation has been devoted to finding a way to do bunching by machinery. The same problem is involved in thinning young cotton plants. Implements have been invented for bunching cotton plants, and are now in successful operation. It is not improbable that implements will be perfected for bunching sugar beets. Some have been devised, but time will be required for their perfection. Bunching and thinning in the growth of the sugar beets consumes time and adds much to the expense. Any implement which reduces the cost will lessen the expense of beet culture.

CULTIVATION.

The term cultivation as here used covers all work done with team and harrow or cultivator to keep the soil of the beet field in a mellow condition and to destroy grass and weeds. This cultivation should begin early. Before planting a spike-tooth harrow should be run over the field one or more times to keep it in good condition and to destroy the early starting weeds and grass. It is sometimes a good plan to thoroughly loosen up the ground with a cultivator, following it with a harrow. It is sometimes advisable to use a "float," or a roller. The harrowing should be continued after the seed is planted to prevent the formation of a crust after rains and to keep down the weeds and grass. Beets may be harrowed two or three times after

they are up without any material injury to the plants. Later the cultivator should be used from three to five times, depending on conditions. The aim should be to do as much team work as possible so as to lessen the amount of hand work, which is more expensive. More or less hand work will be necessary, however, to keep the field clean. This will consist in using the hoe, and pulling such weeds and grass as can not be removed with the hoe.

DRAINAGE.

In a beet field it is just as necessary to remove the excess of moisture as it is for plants to receive a sufficient supply for their growth. The problem of drainage varies greatly, according to conditions. In districts receiving rainfall, the ground may be flat. Precipitation may be more than is necessary for immediate use. In low places the water may stand in pools. This may be followed by a few hot summer days. I have seen areas to the extent of an acre or two absolutely destroyed by what the farmers call "scalding." This may occur even where tile drains have been put in, as has been the case in the beet fields around Fremont, Ohio, and St. Louis, Mich. In these districts a system of surface drainage seems to be advisable. In plowing the land, dead furrows are left from a rod and a half to two rods apart, remaining there throughout the period of cultivation. The surface water naturally runs into these dead furrows, which are connected at the end of the field with an open ditch. Such drainage takes care of an excess of water in a short time.

Excessive moisture on the land retards much of the work of beet culture, prevents cultivation at the proper time, delays the harvest, and naturally increases the cost of the crop. Beet lands should be well drained.

It often happens in the intermountain and coast States, where the soil is watered by irrigation, that alkali salts are brought from the lower depth to the surface. The problem presented here is different from the one requiring surface drainage. Subdrainage becomes a necessity. Such land should be thoroughly tiled. Irrigation water seeping through the soil dissolves the detrimental salts and carries them off permanently through the tile drains.

The large sugar factory at Oxnard, Cal., has a large farm which is quite seriously affected with alkali. The management of this factory, in cooperation with the Government, has been conducting extensive experiments for removing this alkali by the aid of irrigation and subdrainage. The experiments have greatly benefited the land. Through this method a large tract adapted to growing sugar beets and crops of all kinds has been restored to usefulness.

CROP ROTATION AND FERTILIZATION.

Crop rotation and the fertilizing of the soil are matters of great importance in sugar-beet culture. This fact is emphasized by results in the beet districts from year to year.

Every farmer should understand that he can not continuously grow any crop on the same ground and secure maximum results. Many try to do this, but they do it to their own loss and the depletion of the soil. I am often asked if sugar beets as a crop exhaust the soil. This question can not be answered satisfactorily with a plain "yes" or "no." Every farmer should know that plants, of whatever kind, take from the soil some of its plant-food constituents. If the question were "Can I so handle my soil as to grow beets and maintain its fertility?" the answer would be "yes," and the same answer applies to any other field crop. Sugar beets have been grown as a leading crop in many districts of Europe for a long period with increasing productiveness of the soil. This has been accomplished by a system of rotation and fertilization. A similar system must be followed in this country, and considerable progress has already been made in this direction in some of the older beet-growing districts.

One of the great objects of crop rotation is to bring about and maintain an equilibrium of soil constituents and conditions. The best rotation is the one in which the method of culture and action of the plant each year leaves the soil in the best condition for the following crop. It is not my purpose at present to map out definite rotations, but rather to strongly enforce the principle and recommend the adoption of a system of rotation in connection with sugar-beet growing. The crops which should enter into this rotation will differ with the locality and the circumstances. A good rotation for many beet-growing districts will include, in addition to sugar beets, corn, small grain, and a leguminous crop. It is perhaps best to let the beet crop follow either the corn or the small grain.

Sugar beets make heavy demands on the soil, and all soils used in growing this crop should be reenforced to some extent each year. This can be done in three ways: (1) By the application of barnyard manure; (2) by green manuring, and (3) by applying commercial fertilizers. If the soil lacks humus, it must be supplied. Barnyard manure and green crops plowed under are best for this purpose. These are excellent also for increasing the supply of available plant food in the soil. To increase the supply of nitrogen in the soil, crops of legumes may be plowed under. Potash and phosphoric acid may be supplied by commercial fertilizers. The aim should be to keep the land well balanced in its plant-food constituents. Some lands will undoubtedly be benefited by applications of lime to correct an acid condition of the soil and to assist in making the plant food in the soil available. It is usually best to apply barnyard manure with the crop *preceding the sugar beets.*

STATUS AND CONDITIONS OF THE BEET-SUGAR INDUSTRY IN 1907.

The status of the beet-sugar industry in the different States and the climatic and other conditions prevailing in 1907 are briefly shown here.

BEET-SUGAR PLANTS IN THE UNITED STATES.

The following table gives a complete list of beet-sugar plants in the United States, arranged by States, showing the official names of the manufacturing companies and the locations of the factories. It also shows the daily slicing capacity, expressed in tons of beets, for each factory, the combined daily slicing capacity of the factories in each State, and the aggregate capacity of all the factories in the United States.

Beet-sugar companies and factories of the United States.

CALIFORNIA.

Manufacturing companies.	Factory locations.	Number of factories.	Daily slicing capacity.
			Tons of beets.
Alameda Sugar Co.	Alvarado		800
Los Alamitos Sugar Co.	Los Alamitos		700
Spreckels Sugar Co.	Spreckels		3,000
Union Sugar Co.	Betteravia		600
American Beet Sugar Co., main office 32 Nassau street, New York; Pacific coast office, 604 Mission street, San Francisco.	Chino		900
	Oxnard		2,000
Pacific Sugar Corporation, Los Angeles, Cal.	Visalia		400
Pacific Sugar Construction Co.	Hamilton City		700
Total		8	9,100

COLORADO.

American Beet Sugar Co., 1530 Sixteenth street, Denver, Colo.	Rocky Ford		1,100
	Lamar		600
	Las Animas		700
Holly Sugar Co.	Holly		600
Holly Construction Co.	Swink		1,200
National Sugar Manufacturing Co.	Sugar City		500
The Great Western Sugar Co., general offices Sugar Building, Denver, Colo.	Eaton		600
	Greeley		600
	Loveland		1,200
	New Windsor		600
	Longmont		1,200
	Fort Collins		1,200
	Sterling		600
	Brush		600
	Fort Morgan		600
The Western Sugar and Land Co.	Grand Junction		600
Total		16	12,500

IDAHO.

Utah-Idaho Sugar Co., main office Salt Lake City, Utah.	Idaho Falls		1,200
	Sugar		1,200
	Blackfoot		600
	Nampa		750
Total		4	3,750

Beet-sugar companies and factories of the United States—Continued.

ILLINOIS.

Manufacturing companies.	Factory locations.	Number of factories.	Daily slicing capacity.
			Tons of beets.
Chas. Pope, Chicago, Ill.	Riverdale	1	350

IOWA.

Iowa Sugar Co.	Waverly	1	500

KANSAS.

United States Sugar and Land Co.	Garden City	1	850

MICHIGAN.

Michigan Sugar Co., general offices Saginaw, Mich.	Bay City		600
	Caro		1,200
	Alma		750
	Carrollton		800
	Sebewaing		600
	Croswell		600
West Bay City Sugar Co.	Bay City, West Side		600
Holland Sugar Co.	Holland		350
Owosso Sugar Co., main office Bay City, Mich.	Owosso		1,200
	Lansing		600
German-American Sugar Co.	Bay City, Station A		650
Mt. Clemens Sugar Co.	Mt. Clemens		600
Menominee River Sugar Co.	Menominee		1,200
St. Louis Sugar Co.	St. Louis		600
The Continental Sugar Co., main office Cleveland, Ohio.	Blissfield		600
West Michigan Sugar Co.	Charlevoix		600
Total		16	11,550

MINNESOTA.

Carver County Sugar Co.	Chaska	1	600

MONTANA.

The Great Western Sugar Co.	Billings	1	1,200

NEBRASKA.

American Beet Sugar Co.	Grand Island	1	350

NEW YORK.

Lyons Beet Sugar Refining Co.	Lyons	1	600

OHIO.

Continental Sugar Co.	Fremont	1	400

OREGON.

Amalgamated Sugar Co.	La Grande	1	400

Beet-sugar companies and factories of the United States—Continued.

UTAH.

Manufacturing companies.	Factory locations.	Number of factories.	Daily slicing capacity.
			Tons of beets.
Amalgamated Sugar Co., office Ogden, Utah	Logan		600
	Ogden		400
Lewiston Sugar Co	Lewiston		600
Utah-Idaho Sugar Co., main office Salt Lake City, Utah.	Lehi [a]		1,200
	Garland		1,200
Total		5	4,000

WASHINGTON.

Washington State Sugar Co., main office Spokane, Wash.	Waverly	1	500

WISCONSIN.

Wisconsin Sugar Co., main office Milwaukee, Wis	Menomonee Falls		500
Chippewa Sugar Co., main office Milwaukee, Wis	Chippewa Falls		600
Rock County Sugar Co	Janesville		600
United States Sugar Co	Madison		600
Total		4	2,300
Grand total		63	48,950

[a] Slicing stations at Springville, Spanish Fork, and Provo.

CALIFORNIA.

The beet-sugar industry has been established in California longer than in any other State in the Union. At present there are 8 factories operating: At Alvarado, Los Alamitos, Spreckels, Betteravia, Chino, Oxnard, Visalia, and Hamilton City. There is a large factory at Watsonville, belonging to the Spreckels Sugar Company, which has not been in operation for several years. The one owned by this company at Spreckels is the largest, but one, in the world. This company has devoted its energies to developing beet production for this factory, whose capacity is 3,000 tons of beets per day.

Another factory located at Crockett, belonging to the California Beet and Hawaiian Sugar and Refining Company, operated several years as a beet-sugar factory, when it abandoned production and devoted its energies entirely to refining. Altogether 10 factories have been installed in the State.

Originally most sugar beets were produced in California by rainfall. The beets can be planted much earlier as a rule than in most sections. Sufficient moisture was secured during the rainy season of the winter. The older factories were principally on the coast side. The rain falling in the winter was augmented by subirrigation or underground seepage of water from the mountains to the sea. Throughout these coast valleys the crops have been materially increased by installing deep wells.

The recently built factories of the State are largely dependent upon irrigation from the Sacramento and other inland rivers.

In beet cropping there are some unique features in California. Beets can be planted and produced in different valleys at various times of the season. This lengthens the factory campaigns in some cases to six months. The fact that rain falls in the winter, saturating the soil, while there is unbroken sunshine the rest of the year, gives ideal conditions. The California soil is very retentive of moisture. Conditions are such that beets grown in this State are very high in quality and purity.

The principal beet sections are in the San Joaquin and Sacramento valleys, and the coast region from Mendocino to Chino. In this coast region is the wonderful Salinas Valley, 15 miles wide, estimated to contain about 700,000 acres, 200,000 acres of which are under cultivation.

In the State two new factories were built last year, and one new one is under construction for the campaign of 1908. A number of others are under contemplation.

ALVARADO.—Aside from the heavy rainfall of the winter, which retarded planting to some extent, normal conditions existed in the beet-growing districts adjacent to the Alvarado factory. The factory here is the oldest in operation in the United States. Sugar has been produced at this point regularly for twenty-eight years. The campaign opened September 26 and closed December 9.

BETTERAVIA.—At the Betteravia factory quite a number of improvements were made. Its capacity was largely increased. In this district a fine system of irrigation has been installed. Beets of superior quality and purity are the rule. Fair conditions existed throughout the season. Slicing began the middle of July.

CHINO.—The rainfall of winter in and around the Chino factory was quite heavy. This retarded planting somewhat. The season throughout the rest of the year was quite favorable. The company now owns about 5,000 acres, which very materially promotes a supply of beets. This land has been improved by drainage to remove the excess of rainfall. This expedites preparation of the seed bed at the right time. The average yield of beets was fairly good. The factory began slicing August 26 and closed October 21.

HAMILTON CITY.—The Hamilton City factory, which made its second campaign in 1907, is a 700-ton plant. This factory was built two years ago in a new district, and it illustrates the wonderful developing influence of a beet-sugar plant. The management of this factory conducts its affairs along progressive lines. Much of the ground is broken up by large traction plows. One large traction plow was in use this year which is said to cut 25 furrows at once. Many *improvements* to promote the work of the beet production and the

manufacture of sugar were installed during the year. A pontoon bridge was built across the river in order to develop a large territory on the other side for beet and general crop production. This facilitated delivery to the factory. The large traction engine is used to deliver beets to the factory, propelling long trains of wagons. The management of the factory has procured a large number of Japanese laborers. Country dumps were installed to accommodate the farmers. The beets grown were of high quality. The factory began slicing September 9 and closed November 9.

LOS ALAMITOS.—The Los Alamitos factory, situated about 30 miles south from Los Angeles on a flat plain, is located near the coast. Most beets furnished for it are grown in its immediate vicinity and around Anaheim. This factory was originally a 400-ton plant. At the beginning, cropping depended upon the full saturation of the soil in winter supplemented by occasional rains during the growing season. This condition has been improved by irrigation from a system of deep wells. During the last few years the capacity of the plant has been practically doubled. For several reasons it has been one of the most successful enterprises in sugar production on the coast. Beets delivered to this factory average the highest in sugar and purity of any in the United States, or in the world, so far as I have record. Last year (1907) the average for the entire campaign was: Sugar, 19.3 per cent with an average purity of 84.8.

I clip from a local paper a list of the averages, covering a period of ten days, of this factory's run from August 31 to September 11, inclusive, which is most remarkable, and probably has never been excelled in the history of beet-sugar production:

Sugar contents and purity of beets grown in southern California, 1907.

Date.	Coefficient of purity.	Percentage of sugar.	Date.	Coefficient of purity.	Percentage of sugar.
August 31	85.4	20.2	September 6	85.7	20.4
September 2	85.8	21.0	September 7	85.8	20.7
September 3	85.7	21.2	September 9	85.1	20.7
September 4	86.2	20.9	September 10	84.9	21.1
September 5	86.1	20.4	September 11	84.8	20.7

From the same paper I also clip an account of the experimental work by a big land-holding company, which shows the development of the district, especially in irrigation, and the draining of land to remove the alkali and excess waters from the overflow of irrigation or excessive rain:

The Bixby Land Company last season put in a 40-acre experimental plat of tile draining and this year it will be increased to 160 acres of alkali land, which formerly was in pasture, being considered unfit for cultivation. The method of operations is, after laying the tiles, to close the outlet and flood the land thoroughly, then open up and let the water which has become alkaline drain off; this operation it repeats time after time until the excess of alkali in the soil has been removed. After this the land

may be irrigated and put into cultivation as any other land. When irrigation water is applied afterwards from artesian wells, the drainage system permits the surplus to drain off and the land is found to be very fertile and productive. The total cost for tiling and labor is said to be from $60 to $70 per acre.

In this district a new device for harvesting beets was in use during the season. It was a combined beet topper, puller, and cleaner. This implement is propelled by two horses. It gave excellent results in this locality. The yield of beets was better than usual. The locality rarely receives an excess of rain in October, but this occurred in 1907, and lowered the general average quality. But for this, the beets would probably have shown over 20 per cent sugar and 85 of purity.

The factory started slicing beets August 15 and closed November 25.

OXNARD.—The Oxnard factory from every standpoint is the ideal factory in the United States. It has a capacity of 2,000 tons, and secures a sufficient supply of beets each year to make a long campaign. The beets are of high quality and purity, and the average tonnage per acre is high. This acreage and quality of beets benefits both the farmers and the factory. The factory has maintained a high record from the beginning. In 1907 climatic conditions were uniformly good, except that heavy rains in the early season retarded the planting and early work. The beets produced during the past season were of unusually high quality. The factory started slicing August 17 and closed November 9.

SPRECKELS.—The Spreckels factory is the most remarkable in many respects of any in the country; principally on account of its size and the development of all conditions that have to do with its wonderful work. It has a capacity of 3,000 tons of beets daily. It is located in one of the largest and most fertile valleys on the coast side of California. It has been the means, more than any other, of influencing and stimulating the improvement of conditions in this large agricultural tract. It consumes 13,000,000 gallons of water in twenty-four hours. Water for irrigation is taken from the river by two centrifugal pumps, having capacities of 10,000,000 gallons in twenty-four hours, each being operated by two large motors. This water is forced through a mile and a half of 32-inch wrought-steel-riveted pipes, and is stored in tanks from which it is taken into the mill by power pumps. Most of the labor on the land in this district is performed by Japanese.

During the earthquake this plant was badly wrecked, requiring a heavy expense to restore it to condition for work during the compaign of 1906. This was accomplished, however, and to-day the plant stands in as good condition as before its injury if not better.

Late rains during the campaign of 1906 interfered with harvesting all the beets. The plant closed before all could be worked. How-

ever, on the opening of the factory several months later for the campaign of 1907, these beets were harvested. They still had sufficient value to compensate the farmers for producing them and the factory for their manufacture into sugar. This illustrates the wonderful adaptation of this section to the beet-sugar industry.

VISALIA.—A factory of 400 tons capacity operated at Visalia its second campaign in 1907. At the time of the installment of this factory conditions were new and much development work was necessary. The management of this factory is meeting all obstacles and will make a record in California. Among the improvements which may be mentioned, the management is installing an automatic dumping system in its beet sheds, bottom-dump railway cars, and special dump wagons. It has also established country dumps along the railway systems which penetrate the district.

COLORADO.

This State heads all others in the development of the beet-sugar industry. It has more wealth invested in the industry than any other. The State is favorably situated, occupying the center of that vast territory west of the Missouri River. It has railroads, mining interests, and general facilities for manufacturing. Agriculture has developed very fast; it has even outstripped mining. The State has wonderfully productive valleys. Stretching from the mountains to its northeast corner is the Platte River, furnishing the water for opening up large tracts of land adapted to agricultural production. In the south, running east from the mountains through the State, is the Arkansas River, supplying irrigation for the development of agricultural resources of all kinds. Running west from the mountains, is the Grand River with its extensive fertile valleys, producing fruit, sugar beets, and other crops.

Outside of the rivers mentioned, there are many fertile valleys drained by smaller streams, carrying water from the deposits of snow and the rainfall in the mountains. In these valleys the sugar industry has taken a firm hold. It has induced the building of large irrigation projects. Other lines of intensive agriculture are following the establishment of the sugar industry. North of Denver in that agricultural section tributary to the Platte River and to the reservoirs for impounding the first drainage of the Rockies are 9 factories at the following places: Eaton, Greeley, Loveland, New Windsor, Longmont, Fort Collins, Sterling, Brush, and Fort Morgan. Along the Arkansas River are 6 factories at the following places: Rocky Ford, Lamar, Las Animas, Holly, Swink, and Sugar City. Along the Grand River in the west is one factory at Grand Junction.

There is hardly a valley anywhere in the State with a sufficient supply of irrigation water that is not under investigation with a view

to establishing the sugar industry. In the well-established districts, land is worth from $200 to $300 per acre.

Colorado averages high in tonnage of beets and without exception beets are of high quality. At the present time, every factory in the State is making a remarkable success of the sugar business. With one exception this has been true of all from the start. The commercial, manufacturing, and agricultural industries of the State have been aided much by the development of the sugar industry. In a few years it has built railroads, towns, and irrigation works. It has rapidly increased the population and wealth, has attracted capital, and built up enterprises that go to make a State great.

The value of the beet crop to the land has been demonstrated by the experience of Colorado farmers, as is shown by the following clipping from a recent issue of the Denver Field and Farm:

> Every observing man must have noticed that the advent of the sugar industry in Colorado has surely had an effervescing effect on land values, and this is one of the most satisfactory features arising from the business. We have seen the land advance in price from $30 or $50 to $200 or $300 an acre, but we must imagine that the latter figure is about the limit, when the earning capacity of a farm is based on its percentage of profit from annual crops. The effect of beet culture has been to bring down the average size of the farms to 20 or 30 acres, but of course we still have many of 100 to 300 in extent. As intensive farming is the rule, however, the ordinary grower finds 20 or 30 acres about all he can manage when put in beets, dependent as he is upon the uncertainties of such labor as may stray along. Another salutary effect has been the improvement in cultural methods, and this is shown tentatively in all other crops. The introduction of alfalfa as a fertilizer to beet lands has proven a great stroke in advancing the science of farming, for the system is gradually coming into use in all other lines of farm production in places where the fertility of the soil is deteriorating.

In the country adjacent to the factories on the Arkansas River the spring was late and there were late frosts. In July there were heavy rains, and in August the weather was exceedingly hot.

In the northern part of the State there was lack of moisture to germinate the seed in the spring, but the balance of the season was favorable.

BRUSH.—The Brush factory of 600 tons capacity made its second campaign in 1907. Considering that it is a new plant, its work may be pronounced very satisfactory.

EATON.—Sugar factory at Eaton, under the management of the Great Western Sugar Company, has been in operation for several years. This is one of the well-developed wheat and potato growing districts of Colorado. As the district is thoroughly equipped with irrigation facilities the factory has been a success from the start. The past year was one of the most successful in its career.

FORT COLLINS.—At Fort Collins is operated one of the largest sugar factories in northern Colorado. It is one of the plants operated by the Great Western Sugar Company. This is the home of the

State Agricultural College and Experiment Station. The district is well developed. Beets yield high tonnage and are of the best quality. Conditions were about normal, and results were favorable.

FORT MORGAN.—At Fort Morgan a new factory has been operated by the Great Western Sugar Company for two years. Beets are grown by irrigation, the water supply coming from the Platte River.

GREELEY.—At Greeley is a plant of 600 tons capacity, the property of the Great Western Sugar Company. This is one of the oldest and best-established agricultural districts in northern Colorado. This plant is one of the best illustrations of the success of a factory resulting from conditions developed prior to its establishment.

GRAND JUNCTION.—At Grand Junction a factory was started in a district almost entirely devoted to fruit culture. It was an innovation. After a struggle for a couple of years, it was closed for two years, then reorganized, and is now one of the most successful in the State.

HOLLY.—At Holly is a factory, built two years ago, beets for which are grown on lands tributary to the Arkansas River. It is near an older factory at Rocky Ford. It has 600 tons capacity. The weather was extremely hot during the latter part of July and the fore part of August. The factory opened its campaign September 23 and closed January 23.

LAMAR.—At Lamar, in the eastern part of the State, along the Arkansas River, is a plant of 600 tons capacity recently removed from Norfolk, Nebr., which made its second campaign in Colorado last year. During the season the weather was not uniformly favorable. The spring was late and cold. Beets were affected by the very hot weather in August, immediately following a heavy rain in the latter part of July. Leaf spot in August affected the crop to a considerable extent and hail disturbed it in a few districts. The pulp and waste molasses from the factory were disposed of to local feeders.

LAS ANIMAS.—At Las Animas is a new factory which operated for the first time in 1907. Beets are grown on lands tributary to and irrigated by the waters of the Arkansas River. It is in the western part of Bent County, about 40 miles west of Lamar. Climatic conditions were not uniformly favorable. The spring was late and cold and frost continued until the middle of May. Heavy rains occurred in the latter part of July, followed by extremely hot weather. A little damage occurred from insects and plant diseases. Leaf spot occurred with damaging effect to both tonnage and quality. Most of the beet pulp is fed to sheep and the waste molasses is sold to a feed-manufacturing company. No pulp is dried. The campaign opened October 11 and closed January 25.

LOVELAND.—At Loveland is a factory of 1,200 tons capacity. It was one of the earliest constructed in the State and was established in one of the well-developed agricultural districts. It is in a region devoted to wheat, potato, and sheep production. The season during the past year, like that in all the other factory districts in the northern part of the State, may be considered quite favorable.

LONGMONT.—At Longmont is another of the northern factories belonging to the Great Western Sugar Company, and it has 600 tons capacity. It has been operating five years. A full supply of beets was received and a full campaign was made. Beets in this district gave good yield and were of excellent quality. The campaign opened September 23 and closed February 1.

ROCKY FORD.—At Rocky Ford is a large plant of 1,100 tons capacity controlled by the American Beet Sugar Company. It is the second oldest and one of the most successful in sugar production in the State. It is about 45 miles east and a little south of Pueblo. Climatic conditions were quite favorable during the season, except the last week in July and the first part of August. There was comparative freedom from insect pests, diseases, hailstorms, and floods.

All beet pulp is used in a fresh state for feed around this factory. The waste molasses is sold to companies which manufacture stock feed. The campaign opened September 16 and closed February 5.

STERLING.—At Sterling is another of the northern factories belonging to the Great Western Sugar Company. It has 600 tons capacity and has been operating two years. It is located in Logan County, near the northeast corner of the State, on lands irrigated by the Platte River. It is on the Union Pacific Railroad, which is crossed at this point by the Burlington and Missouri River Railroad.

SUGAR CITY.—The plant at Sugar City, of 500 tons capacity, was the third factory established in the State. The company controls about 12,000 acres of land and is able to secure all the beets necessary for a full campaign. It is about 17 miles northeast of Rocky Ford. Beets grown around this factory are irrigated by water from Arkansas River. The spring was very cold and backward. This district suffered from a late frost in the middle of May, but the summer was normal and the fall ideal. Taken altogether, the season was quite favorable. No particular disturbances to the growth of the crop occurred except a slight attack of "leaf blight." Most of the pulp produced at this factory is fed locally. No pulp is dried. Most of the adjacent country is devoted to growing sugar beets and alfalfa. Dairying and creamery interests have not been developed yet. The factory opened September 19 and closed January 15, 1908.

SWINK.—At Swink, which is only a short distance from Holly, in the area tributary to the Arkansas River, is located a factory of

1,200 tons capacity. The campaign of 1907 was its second. It had a very large acreage of beets and a very successful season.

NEW WINDSOR.—At New Windsor is located another of the factories belonging to the Great Western Sugar Company. It has a capacity of 600 tons of beets daily. The season was rather favorable and the results secured were satisfactory.

IDAHO.

Idaho is one of the States which has recently assumed importance in beet-sugar production. Throughout the State, in the valleys tributary to rivers and smaller streams in which this State abounds, exist all favorable conditions for agriculture. At the present time irrigation is largely from running streams. The water resources of the State for this purpose are very extensive. Irrigation is in its infancy. For impounding waters in reservoirs conditions are ideal. The Snake River Valley, extending across southern Idaho from east to west and half way up its western border, has been the principal field of irrigation and agricultural development. Beets grown at the present time are upon land tributary to this stream. At the same time many smaller streams draining the mountains offer similar facilities and advantages.

There are now four factories in the State. The first was installed at Idaho Falls five years ago; the second, at Sugar; the third, at Blackfoot, and the fourth at Nampa. All these are along the Snake River. There are many other places in the State well adapted to sugar production, and there is a possibility that other plants will be installed in the near future.

The State of Idaho produces many deciduous fruits adapted to its altitude and climate, such as apples, pears, plums, cherries, small fruit, etc. Idaho is noted for its root crops, and is especially adapted to alfalfa and small grain. Utilization of water for irrigation has hardly begun. The Government Reclamation Service and private enterprises are beginning the storage of waters. In the end this new State will be one of the most important in the Northwest.

The Salt Lake City News of May 4, 1907, gives a fair account of conditions existing in Lincoln County, Idaho:

> Five years ago this district was practically undeveloped. Now it is alive to the development of all its agricultural resources. There are now planted to sugar beets for this factory something over 8,000 acres, with an average yield of 12 tons to the acre. This will give practically 100,000 tons to be harvested and worked up, thereby lengthening the sugar-making campaign nearly one month.
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> Land around the sugar factory five years ago was offered at from $10 to $25 per acre which to-day is selling readily at from $75 to $100. No crop that is grown by the farmer responds so readily or repays with as much certainty the labor bestowed upon it as does the sugar beet. There is no other crop the farmer can count on as certainly as the sugar beet. He is always able to contract his crop a year ahead at a given price; and, taking all things into consideration, the careful farmer finds that the sugar beet is the most profitable crop he can raise.

IDAHO FALLS.—The Utah-Idaho Sugar Company is operating a factory of 1,200 tons capacity at Idaho Falls. Climatic conditions were not up to normal the past season. There was much moisture in the early spring, and the weather was not warm enough the rest of the year for best results. This district suffered severely from hailstorms. There were no serious attacks of insect pests or plant diseases. In this district during the past season a cultivator working 4 rows at a time was used to good advantage. The pulp from the factory is consumed in fattening sheep and cattle. To a certain extent the waste molasses is fed with the pulp. Farmers in the vicinity are buying more cows to get the advantage of feeding pulp. The factory opened September 30 and closed January 5.

SUGAR.—The Utah-Idaho Sugar Company operated a factory at Sugar with 1,200 tons capacity. The weather in the spring was quite cold, and there was excessive rain. The growing season was rather short, retarding beet development. The tonnage was light on poor soils; on rich soils, good. The management of the factory is actively encouraging thorough fertilization, either by plowing under alfalfa, clover, and other green crops, or spreading barnyard manure and commercial fertilizer. The beets in this district were injured to some extent by a worm which appeared in July and September, destroying considerable beet foliage, thus reducing the tonnage. The pulp produced is used for fattening sheep and cattle, and the molasses also to a considerable extent. Dairying has been considerably increased since the installation of the factory.

BLACKFOOT.—Weather conditions around Blackfoot were not particularly favorable; there was too much moisture and cold weather in the spring and not enough warm weather in the summer. Beets in this district suffered severely from hail. There was no occurrence of insect pests or diseases. Pulp is fed to cattle and sheep. Farmers are greatly increasing the number of milch cows. The factory opened October 12 and closed December 24.

NAMPA.—At Nampa the weather was abnormally cold during April and May, stunting the growth of young beets, especially in poorly prepared soil and late planting. There was some complaint of the "white fly." All pulp produced by this factory is used in feeding cattle, and molasses is mixed with it. The dairying and creamery interests are increasing very fast. The factory opened September 15 and closed November 18.

ILLINOIS.

RIVERDALE.—The State of Illinois recently entered the field of beet-sugar production. Mr. Charles Pope, of Chicago, established a plant of 350 tons capacity at Riverdale, a short distance south of Chicago. On account of the shipping facilities, markets, and favor-

able conditions for growing sugar beets this State is well adapted to this industry. The tonnage of beets is heavy and the quality acceptable for sugar production. Eventually Illinois will be one of the States largely engaged in this industry. The early season was somewhat unfavorable on account of excessive rain. Later the season was favorable. There was no trouble on account of pests, diseases, hailstorms, or floods. The factory dries its own pulp. This product with the waste molasses is all consumed in feeding. The beets grown for this factory during the past year averaged over 15 per cent sugar. This is above the minimum of sugar required by factories.

IOWA.

Iowa is one of the recent additions to the list of States producing beet sugar. From several standpoints the northern half of the State is well adapted to this industry. The soil is rich; crops are sure; beets yield well, and they are of sufficiently good quality to meet the requirements of the sugar factory. This State has a long list of reliable crops. In many parts alfalfa can be grown, and clover is a sure crop in most parts of the State. Stock peas and beans can be grown for reinforcing the soil. Root crops like stock beets, turnips, potatoes, and mangel-wurzels can be produced abundantly. Corn is the principal crop, and small grain is grown generally. With this long list of crops, rotation is easily accomplished. The State is one of the principal producers of live stock. This furnishes the barnyard manure for fertilizing.

As in Minnesota, Illinois, and Ohio, land values are high. The incentive to land speculation does not operate to promote the establishment of factories as it does in connection with the cheap lands of the West. For this reason the sugar industry has not developed in proportion to the favorable agricultural conditions.

This State is crossed by railroads from north to south, from east to west, and diagonally. There is no county in the State without railroads. Many counties are crossed by several. It has many thriving towns. These furnish abundant facilities for transportation of the raw material and finished products and also the market for the sugar and by-products. Every indication points to the northern half of the State as territory that will eventually engage extensively in the beet-sugar industry.

WAVERLY.—A plant was established at Waverly of 400 tons capacity. The season was very unfavorable for all sorts of cropping in this district. This is one of the oldest and best established grain belts in the State, but most crops partially failed last season. Naturally sugar beets were not of the best. I went over the district last fall. While it may be said this crop was not the success desired, yet,

compared with other crops, results were most favorable. It must be considered that this crop was grown by farmers new to the business and conditions were little understood. Yet it gave fair results in comparison with general crop conditions.

The district suffered from excessive rains during most of the growing season. These rains started early in the season. The spring was cold and conditions were entirely unfavorable to planting or starting any crops. It is claimed that such adverse conditions had not existed in the district for twenty-five years. The test of sugar beets under these circumstances was not such as to indicate possibilities. However, there are many things that warrant confidence in the future success of this plant.

KANSAS.

The State of Kansas has been quite thoroughly tested in all parts by private companies, local associations, the Government, and the State experiment station. In the western half of the State, along the Arkansas River, conditions were quite similar to those in Colorado along this stream, where a number of sugar plants have been established. Experiments have demonstrated that there are many places along this stream adapted to the culture of sugar beets and the production of sugar.

GARDEN CITY.—A few years ago the State legislature, to encourage the beet-sugar industry, offered a bounty of $1 a ton for beets grown in the State. Many farmers in the western part grew small acreages and shipped their product to the factories in Colorado. This resulted in the building, in 1906, of a large factory at Garden City, in Finney County. This factory has a capacity of 850 tons of beets per day. This county is penetrated by the Arkansas River. Results at this plant have been so favorable that capitalists have been planning the establishment of three or four others in the vicinity where beets will be grown under similar conditions. The installation of this plant inspired the making of a large irrigation ditch. This has developed a large scope of country devoted to general cropping. It has raised the price of land from $5 to $100 per acre.

The season was not very favorable during the past year. It was cold and dry in the spring, the start of the young plants being thus retarded. During the growing season leaf blight appeared, affecting crops throughout the entire district; also some "crown rot" was in evidence. Two new devices for harvesting sugar beets were tried, but were not entirely successful. The pulp produced at this factory is all fed to stock. This plant has the most modern processes and very little waste molasses is turned out. The capacity of the factory was increased last year from 600 to 850 tons.

MICHIGAN.

In the State of Michigan more beet-sugar factories have been installed than in any other State. The completed list of 22 factories built is as follows:

Full list of beet-sugar factories installed in Michigan, with names, locations, and daily slicing capacities in tons of beets.

	Tons.		Tons.
Bay City (Station A)	650	Croswell	600
Bay City (West Side)	600	Menominee	1,200
Caro	1,200	St. Louis	500
Alma	600	Holland	350
Sebewaing	600	East Tawas	600
Bay City	500	Kalamazoo	500
Bay City	600	Rochester	500
Lansing	600	Benton Harbor	500
Owosso	1,200	Marine City	350
Carrollton	700	Charlevoix	350
Mount Clemens	600	Blissfield	600

While the State is well adapted to this industry, many of these enterprises were immaturely launched. In installing the sugar industry, factories were too closely bunched. It became necessary to remove several of them to other places.

This State has now in active operation 16 factories located as follows: Bay City, Caro, Alma, Carrollton, Sebewaing, Croswell, West Bay City, Holland, Owosso, Lansing, Mount Clemens, Menominee, St. Louis, Blissfield, Charlevoix, and that of the German-American Sugar Company near Bay City. It is fair to presume that the present factories will continue as successful enterprises. Others may be installed with the development of conditions.

The State of Michigan is largely interested in copper and coal mining. A few years ago it was one of the leading States in lumber production. Its railroads and other improvements were based largely upon these. The lumber industry is practically at an end. It has a large area of vacant stump lands, which represent its former business. These lands are cheap, and recently capital has been attracted toward these undeveloped resources.

Transportation lines penetrate the lower peninsula in every direction. It lies near the great commercial centers of the Middle West—Milwaukee, Detroit, Buffalo, Toledo, Cleveland, and Chicago. It is surrounded on the north, east, and west by the Great Lakes, and all these places are accessible from it by water transportation. Michigan probably enjoys the cheapest freight rates of any State in the Union. All this redounds to the benefit of a great industry like sugar making. Considering transportation alone, there is no State better adapted to the sugar industry. The soil also is generally

better adapted. The farmers are developing diversified agriculture, including stock raising, dairying, creameries, fruit growing, and the production of hay, small grain, and root crops. This diversification promotes crop rotation.

Unlike many States in the East, Michigan has large areas of cheap lands offering inducements for speculation and development.

In the growing of sugar beets there are some obstacles in Michigan. There is a liability to early and excessive rains in spring and fall. The first interfere with planting and early cultivation of beets; the last with harvesting, and sometimes they lower the quality of the beets.

At present one of the most pronounced indications favorable to the sugar industry in the State is the tendency of farmers to contract with factories to grow beets. Two or three years ago an insufficient supply was one of the main difficulties, and one which appeared insurmountable, but it has apparently disappeared. In Michigan the factories have nearly all contracted for their entire acreage for 1908 before March 1. Several factory managements refused many contracts from lack of capacity to handle the beets. Taking everything into consideration, the prospects of the sugar industry in the State of Michigan are propitious.

At several of the Michigan factories the beet growers assemble each year at the invitation of the company on what is called "farmers' day." The growers are shown through the plant, and the different steps and processes in the manufacture of sugar are explained. Usually there is a programme of addresses, music, etc. As many as 5,000 persons have attended a single meeting of this kind.

The following from the Saginaw (Mich.) Herald of October 27, 1907, indicates the character of these gatherings:

> The company is arranging to entertain 4,000 to 5,000 beet growers on farmers' day, Saturday. This day has become a big annual event for the beet growers and is a good thing all around. The farmers meet and exchange experiences in the culture of sugar beets and other farm crops and sometimes listen to addresses on sugar-beet culture by experts. It will be remembered that perhaps the most valuable address on this line here was delivered by Secretary of Agriculture Wilson.
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> The company will use its big warehouse as a banquet hall and here lunches will be served all day to all the visitors. Arrangements are being made for music and speaking. There will be an address of welcome by Mayor Baum and addresses will also be made by other speakers, including probably some of the leading beet growers. On this day all the stations will be closed down and all the company's outside representatives, agriculturists, etc., will be called in to help entertain the farmers at the factory.

Many obstacles were encountered in the first years of the industry in Michigan. The farmers were not educated in beet culture, and, anticipating enormous profits, large acreages were planted by individuals and firms, and bad seasons and difficulty in obtaining labor

to care for and harvest the beets involved heavy losses in some instances. Exaggerated stories of enormous profits in the business caused the people to rush into the construction of sugar factories without due regard for the supply of beets that could be grown in the territory tributary to them. All of these things operated against the industry at the outset. Many farmers declined to engage in the industry after the first two or three seasons, and this forced a number of factories out of the State.

The plants at Benton Harbor and Kalamazoo were taken down and removed to Wisconsin, new companies being formed to operate the same. The Rochester plant was also removed to Wisconsin, the Saginaw to Colorado, and the Michigan Bay City to Waverly, Iowa. Bay City has three factories remaining and in successful operation.

A company was organized and a fine 600-ton plant was erected at East Tawas, but it was only operated one season, the farmers not producing enough beets to sustain it, and it was removed to Chaska, Minn.

Driers have been installed to convert the wet pulp from the factories into dried pulp at Alma, Bay City, and Sebewaing, two of the factories being thus equipped at an expense of nearly $100,000 each. The Owosso plant put in a drying plant last year. During the compaign of 1906, 10,000 tons of dried pulp was produced and baled in Michigan. Shipments have been made to Savannah, Mobile, New Orleans, and other southern points, and to many eastern points. It is confidently expected that, as the merits of this food for live stock become better known, the consumption of it will rapidly increase.

The following figures for the year 1906 will serve to show the magnitude of the beet-sugar industry in Michigan:

In the season of 1906, 30,000 farmers in Michigan raised beets, and 94,000 acres of beets were harvested, producing 800,000 tons of beets.

The campaign of the factories averaged approximately eighty-five days, and the output was 177,000,000 pounds of granulated sugar, or more than the yearly consumption of sugar of all kinds in the State.

In the operation of the factories in Michigan 150,000 tons of coal were consumed, two-thirds of which was produced in Michigan, and 50,000 tons of limestone, all of which was produced in Michigan; also 3,000 tons of coke.

The beet growers in the State were paid $4,000,000 for beets and the value of the sugar produced is estimated at $8,250,000.

The pay roll of the factories averaged over $50,000 for each factory.

The beet-sugar industry has been of immense advantage to the railroads in the sugar-producing districts of the State. During the last campaign the railroads hauled 34,500 cars of sugar beets. The freight bills paid to the roads amounted to $750,000.

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The 94,000 acres of beets raised in the campaign paid to the railroads in freight an average of $8 for each acre harvested.

A comparison of the tonnage of beets with that of other agricultural products explains the excessive amount of freight furnished by beets. An acre of wheat or corn produces approximately 1,000 pounds of freight, while an acre of beets produces 20,000 pounds of freight. The beet-sugar industry has not only furnished the railroads with a vast tonnage, but it has been of great value as a promoter of good roads. Farmers growing beets are naturally concerned in good roads when the period of hauling the beets to the cars or to the factory arrives, and they have used their influence throughout the State to excellent advantage in doing everything that they could to further the construction and maintenance of good roads.

BAY CITY (Michigan Sugar Company).—Within 20 miles of Bay City 6 factories were originally built. Three have been removed. Those remaining are enjoying successful careers. In this district the early season was cold; during August it was too dry. Hail storms occurred in certain localities, doing considerable damage. The Bay City plant of the Michigan Sugar Company has a capacity of 600 tons. It is drying and shipping its pulp. Not much pulp is used locally. Some of the plants in this vicinity, which do not dry their pulp, give it free to the farmers. Eventually, in Michigan, this loss to the sugar industry will cease. The green or dried pulp will have an established permanent market like the sugar product. The plant opened October 19 and closed January 3.

Bay City, Mich., is the real center of thought, inspiration, and enterprise for the beet-sugar industry of the State. The industry in this State is fostered by an association representing the managements of the different factories. Annually a report of the progress and the results of the industry is compiled under the direction of this association.

BAY CITY (West Bay City Sugar Company).—This factory has a slicing capacity of 600 tons of beets daily. The seasonal conditions were the same as those described above.

BAY CITY (German-American Sugar Company).—The German-American Sugar Company also operates a plant of 650 tons capacity near Bay City. The conditions were the same as for the other factories at this place. Wire worms did some damage in beet fields. The factory dries all its pulp and markets it in New York. Waste molasses is sold for the manufacture of alcohol. A new electric-light plant was installed during the season of 1907. The company opened October 23 and closed December 17.

CARO.—The Caro plant is operated by the Michigan Sugar Company. It originally had a capacity of 600 tons of beets daily, but was later enlarged to 1,200 tons. The spring was late; in July and August

it was excessively dry, and there was heavy rainfall in September. During the harvesting months the weather was exceptionally fine. Around this plant wire worms did some damage, and the crops were slightly affected by hail. Farmers consume for feeding all the green pulp, consequently the plant does not dry this by-product. Dairying and creamery interests have been greatly benefited by the pulp output. The campaign opened October 23 and closed December 17.

ALMA.—The plant located at Alma, of 750 tons capacity, also belongs to the Michigan Sugar Company. In the northern part of the territory growing beets for this factory, weather conditions were ideal throughout the season. In the vicinity of the plant and farther south considerable drought prevailed during the latter part of July and August. The season as a whole may be considered an average. There was very little blight, and in a few localities wire worms were active, slightly injuring the crops. There was some damage from hail. This factory dries its pulp and ships it away. The waste molasses is sold and shipped to a company for manufacturing into alcohol. Dairying and creamery interests are developing very fast.

CARROLLTON.—At Carrollton a plant of 800 tons capacity is operating under the Michigan Sugar Company. The early season was late and cold, followed by a dry summer, there being a period of forty-five days without rain. The drought affected the beets. There was some leaf blight. Severe hail did considerable damage, and more was done by wire worms. The factory does not dry its pulp. The farmers use most of the green pulp for feeding their stock. Dairying and creamery interests are developing very fast. The factory opened October 16 and closed January 11.

SEBEWAING.—At Sebewaing is a plant of 600 tons capacity, operating under the management of the Michigan Sugar Company. The early spring was favorable, followed by wet weather after seeding, and extremely dry conditions through July and August. Excessive rains in September tended to increase the tonnage. This was followed by good weather, which improved the quality of the beets. Cut worms were in evidence, also dry rot in the beets, both doing some damage. This factory dries pulp for shipment. Pulp is used locally for feeding cattle. The molasses is partly shipped for alcohol production and partly fed with pulp. The factory opened October 16 and closed January 9.

HOLLAND.—The Holland Sugar Company is operating a plant of 350 tons capacity. As a rule the season was quite wet. Heavy rainfall in the first part of July, followed by excessively hot weather, injured the tap roots. All the molasses produced by the factory is sold for manufacture into alcohol. Only half of the pulp is consumed by farmers for feeding. The factory is not drying its pulp. The campaign opened October 15 and closed December 25.

Owosso.—At Owosso is a plant of 1,200 tons capacity belonging to the Owosso Sugar Company. The early spring was cold and wet, and snow fell up to the 15th of May. The growing season was very dry, but during the harvesting season it was quite wet. This factory dries pulp for the market. A pulp drier was installed last season. Waste molasses is sold for the manufacture of alcohol. The campaign of the factory opened October 16 and closed December 27.

Lansing.—The Owosso Sugar Company is operating a plant at Lansing of 600 tons capacity. The spring was wet, cold, and backward. The summer season was quite dry, and the fall during the harvest season quite wet. No serious injuries were wrought by insect pests, plant diseases, hailstorms, or floods. This plant is drying its pulp and shipping it away. Pulp is not used extensively in the district. The campaign opened October 18 and closed December 12.

Menominee.—The Menominee River Sugar Company is operating a plant at Menominee of 1,200 tons capacity. On account of the cold, wet spring the season started at least three weeks late. It was dry in August, but June and July were favorable. This plant does not dry its pulp. Most of it is either shipped some distance to consumers, or consumed by local farmers for feeding purposes. The factory gives pulp to its own beet growers on demand. Under the influence of pulp feeding, dairying is increasing very fast. The factory installed a new warehouse. The campaign opened October 18 and closed December 3.

St. Louis.—The St. Louis Sugar Company is operating a plant at St. Louis of 600 tons capacity. Rainfall was a little lacking in July and August, which affected the crop to some extent. Wireworms did some damage. This plant does not dry its pulp. About one-half of it is consumed locally. Its waste molasses is sold for alcohol manufacture. The campaign opened October 10 and closed January 15.

Croswell.—At Croswell a plant of 600 tons capacity is operating under the management of the Michigan Sugar Company. The season at this place was favorable in the early spring. May and June were too wet, but it was very dry in August and the first part of September. A very severe hailstorm did considerable damage, and wireworms were also in evidence to a considerable extent. This plant does not dry its pulp, it being consumed by farmers for feeding stock. The campaign opened October 16 and closed December 8.

Charlevoix.—The West Michigan Sugar Company is operating a plant at Charlevoix in the northern part of the southern peninsula. The season was backward in the spring, affecting the vitality of the young plants. The weather during the growing season was quite favorable, but cold and wet during September and a part of October. Grasshoppers destroyed some of the beets. Conditions around this factory are undoubtedly well adapted to beet growing and the beet-sugar industry. But methods different from those employed around

the older factories in the southern part of the State will be required. Agriculture is not so well developed here, but the management of the plant is making strenuous efforts to work out the problems of beet production, and is gradually accomplishing results. This factory does not dry its pulp, it being all consumed locally for feeding purposes.

BLISSFIELD.—This factory of 600 tons capacity was established in 1905 in southeastern Michigan by the Continental Sugar Company, which owns and operates an older factory at Fremont in northwestern Ohio. This plant appears to have started on a very successful career.

MINNESOTA.

Commercially and agriculturally Minnesota is well adapted to beet production and manufacture of sugar. A factory was operated in this State for several years at St. Louis Park near Minneapolis. The plant was installed in the old Wood's Harvester Company's buildings, which were altered to accommodate sugar manufacture. During the career of this plant sufficient beet-producing acreage was developed to furnish a supply of beets. The plant demonstrated the adaptability of the State to the industry. This factory eventually suffered severely from a cyclone, and a little later was destroyed by fire.

CHASKA.—Another factory of 600 tons capacity was established, at Chaska (the machinery having been removed from East Tawas, Mich.), operating for the first time in 1905. Most of the soil used for growing beets for this factory is a sandy loam and produces beets of good quality, also good yields. There are indications that the State will eventually install more plants and occupy an important place in the list of those producing sugar from beets. The season in the farming district producing beets for the Chaska plant last year was cold and wet in the first part; later weather conditions were more favorable. The plant does not dry its pulp, as it is all consumed by the beet growers. The campaign opened October 15 and closed November 27.

MONTANA.

There are many places in Montana where adaptability to the beet-sugar industry has been demonstrated by experiments. Conditions are very similar to those in Colorado. The industry's development must depend upon irrigation. There is a number of valleys whose streams carry an abundance of water available for beet growing and sugar production. It is apparent that the State is destined eventually to occupy an important place in the sugar industry.

BILLINGS.—A plant was established at Billings of 1,200 tons capacity, which was in operation in 1907. The results during the past season may be considered most favorable for the first campaign.

NEBRASKA.

The first factory in Nebraska was installed at Grand Island in 1890 and a second at Norfolk in 1891. These two were followed in 1899 by one at Leavitt. All these were established in the older well-developed agricultural districts in the eastern half of the State. The factories at Grand Island and Leavitt were located near the Platte River, the beets being produced on the sandy-loam soils tributary to this stream. The factory at Norfolk was operated for fifteen years, and was considered a successful business enterprise. But the American Beet Sugar Company, which owned it, secured a lot of lands in the eastern part of Colorado in the vicinity of Lamar, tributary to the Arkansas River, and the plant was removed to this place to develop these lands.

The plant at Leavitt was originally constructed with 500 tons capacity. A few years ago this was increased to 1,100 tons capacity per day. This improvement was made without sufficient capital, the company fell into financial difficulties, passed into the hands of a receiver, and for these reasons it was unable to contract for beets or operate during the past season. The plants at Leavitt and Grand Island have developed a large beet-growing area out in the western part of the State, where beets are grown largely by irrigation. Most of the beets consumed by these two plants for the last three years have been produced in this western semiarid district, irrigated from the Platte River, in Lincoln and adjoining counties. These beets are usually of high quality, and have proven a satisfactory farm crop. A couple of years ago this district produced 11,000 acres for these two factories.

GRAND ISLAND.—On account of the removal of the plant from Norfolk and the stoppage of the one at Leavitt, the plant at Grand Island was the only one operating in the State during the season of 1907. The early season was not favorable for beets. The spring was cold and late, delaying planting. Ideal conditions existed throughout the growing months of the summer. The beet crop matured late in September. This plant does not dry its pulp. The by-product is consumed by local farmers and others in the State. The entire output is sold in advance of its production. The demand for this pulp is increasing very fast. The first few years in the factory's history most of it was thrown away. The plant was opened October 7 and closed December 2.

NEW YORK.

LYONS.—The State of New York has one sugar factory of 600 tons capacity, located at Lyons. There are many things favorable to beet and sugar production in this State. The State has been paying for several years a bounty of $1 per ton upon all beets grown, conditioned on the factory paying $5 per ton on delivery of beets to be worked into

sugar. There are many places in New York adapted to this industry that may eventually be utilized. The State has several advantages. It is near the best markets for sugar. Its transportation facilities, both for the raw material and the finished products, are excellent and freight charges are low. The farmers are in the habit of using by-products adapted to feeding stock, and these bring the highest market price.

I clip from the Geneva (New York) Gazette of March 21, 1907, a table showing some of the best results secured by farmers who produce beets for this factory. These indicate that, under right conditions, good soil planted to sugar beets and properly cultivated will return from $75 to $125 per acre.

Some of the best results secured by New York beet growers.

Name.	Station.	Acres.	Tons of beets.	Returns.
J. R. Maney	Stanley	3	61.15	$305.74
B. Van Gelder	do	5	92.28	461.40
O. Post	Owasco Lake	10	178.90	894.50
C. Young	Weedsport	1	25.37	126.97
C. A. Webster, superintendent of Monroe County penitentiary.	Rochester	20	329.63	1,648.14
I. Budlong	Scottsville	10	173.16	865.43
J. Staat	Spencerport	2	40.93	204.63
John Snyder	Bergen	10	165.93	829.66
E. Wilcox	do	2	40.10	200.48
Frank Lynch	Leroy	6	129.56	647.78
R. Earll	Batavia	5	89.47	447.36
F. Robert	Getzville	2	40.04	200.20

The season was not as favorable in 1907 as in 1906, but a fair crop was produced. During the growing months of summer the weather was exceedingly dry. As a rule, this improves the quality of the beets, and it did so in this case. The weather was quite changeable during October, November, and December. This plant employs about 175 persons during the campaign.

OHIO.

FREMONT.—At Fremont, Ohio, there is a sugar factory of 400 tons daily capacity. There are many things favorable to the beet-sugar industry in this State. The soil is well adapted, the farms are small, and intensive agriculture of all kinds has been developed. Stock breeding and feeding are among the leading features. Dairying and creamery interests are also developed to a considerable extent. The development work of the factory at Fremont is more pronounced than that of any other eastern factory. For several years it was unable to secure sufficient beets for a full campaign, but now sufficient beets are produced in the vicinity of the plant.

In 1905 a plant of 600 tons capacity was established under the same management in the southern part of Michigan at Blissfield in

order to work the beets produced in that district which had been developed by the Fremont factory. These two plants, controlled by the Continental Sugar Company, can, as a matter of fact, secure more contracts than they require. The company has been very seriously considering the establishment of another plant at Defiance or some other place in the beet districts developed. The results during the past season may be considered favorable and fully equal to those of 1906.

OREGON.

LA GRANDE.—In 1898 a plant of 350 tons capacity was established at La Grande. Largely on account of shipping facilities many contemplated projects for extending the beet-sugar industry have not materialized, though there is a number of places in the State well adapted to the industry.

The sugar factory at La Grande is now a successful enterprise. Its management has been patiently working out all those features that have to do with its success. Originally it had many obstacles, principally the indisposition of farmers to grow the beets. By making contracts in new territory it has extended its beet-growing area. The plant is operated under the management of the Amalgamated Sugar Company, with headquarters at Ogden, Utah.

In the early season weather conditions were unfavorable, being too wet. The beet fields were quite free from insect pests and disease. There was little damage from hail storms, but floods prevented some planting. The pulp produced is not dried, but is mostly sold to local farmers, and the waste molasses to eastern feeders. The factory opened October 3 and closed December 15.

A new industry in connection with sugar production is home-grown seed. Up to date we have depended largely upon importations from Germany and France. There is no question but the sugar industry will be greatly benefited when we produce at home our own seed, adapted and acclimated to our own conditions. To grow pure guaranteed seed requires almost as much expenditure as to build and operate a sugar plant. It requires time to develop the sugar-beet-seed industry in this country. Up to date considerable experimentation has been carried on in this direction. It is found that we can grow high-grade seed where proper facilities are maintained for the purpose. Best results are accomplished in the States of Washington, Utah, California, and Michigan. With the introduction of proper facilities no doubt all the sugar-beet-growing area could be utilized in growing beet seed.

I am especially interested in the statement of Judge Rolapp, secretary and treasurer of the Amalgamated Sugar Company, representing

four large sugar factories, whose report I introduce. He especially calls attention to the fact that all the seed used by his company at La Grande, Oreg., is grown in Fairfield, Wash. It should be noted in this connection that for the entire campaign at the La Grande factory sugar contents of the beets averaged over 16 per cent and purity over 84. This is the highest record ever made in the State of Oregon, and was doubtless due more or less to the use of home-grown seed.

I submit Judge Rolapp's report:

OGDEN, UTAH, *July 17, 1907.*

DEAR SIR: I desire to call your attention to the fact that for the first time in the history of the beet industry American-grown seed has been used exclusively for any given factory. This year at La Grande we have planted nothing except seed from Fairfield, Wash. The beets at La Grande are looking well, and from all appearances there will be very satisfactory results. Of course as a moist year this year is abnormal in these mountains, and results will therefore not be an absolute criterion for other years.

Yours, very truly, HENRY H. ROLAPP.

UTAH.

There are four beet-sugar plants in Utah. This State was the third in the Union to engage in this industry, and the development of the industry has been more nearly ideal than in any other. In response to demand from the developed beet-growing areas, plants have been established systematically. Beets are produced principally on irrigated lands, but both rainfall and irrigation are utilized, the amount of irrigation depending upon the extent of the rainfall. Most of the valley lands of the State are adapted to beet growing. Many of the conditions are ideal for this industry. Farms are small, irrigation systems excellent, and the farming class is industrious and frugal. Under existing conditions, in order to secure a maximum of product from a limited acreage, they would naturally adopt an intensive crop like sugar beets.

The streams coming down from the mountains afford water power, which is converted into electricity for lighting, and propelling machinery, trolley cars, etc. The creamery and dairy interests have developed very fast.

In 1905 the beet growers of Utah were very much disturbed on account of the appearance of an insect that did much damage to beets, commonly known as the "white fly." In 1906 Prof. E. D. Ball, entomologist of the State Experiment Station, investigated the work of insects in this section. The results of his work are indicated in the following letter:

COLUMBUS, OHIO, *January 22, 1907.*

DEAR SIR: I spent six months of last year studying the beet insects for the Government, visiting every locality in Utah and western Colorado several times, and

can report that there was practically no damage at all to the beets in the intermountain area. A very few fields were destroyed in Cache Valley, Utah, by flea-beetles in the early spring, but not nearly as many as usual. Wireworms took one small patch at Garland, Utah, and the beet webworm appeared in small numbers in two or three fields. The beet leaf hopper appeared in very small numbers all over the entire region, but did no appreciable damage. Here and there a "curly beet" was seen, but not as many as in an ordinary season.

The only marked effect following last year's damage was that the mother beets which were saved to raise seed from this year were badly affected with the "curly" leaf, and three-fourths of them withered and died, while the rest did not amount to very much. This was evidently the result of last year's injury, because beets alongside of them from this year's seed showed no sign of damage.

Respectfully, E. D. BALL.

LEHI.—There is a factory at Lehi of 1,200 tons capacity, the first established in the State. The season was quite favorable to beet production. The factory has three slicing stations which extract the juice from the beets and pump it through pipe lines to the main plant. These stations are from 12 to 20 miles distant. The factory is not drying its pulp, but wet pulp is fed extensively. This pulp by-product has had considerable influence in promoting stock raising and dairying. The campaign of the plant began September 23 and closed January 18.

GARLAND.—The Utah-Idaho Sugar Company is operating a plant at Garland of 1,200 tons capacity. Normal conditions prevailed throughout the season, and no serious damage was done by plant diseases, insect pests, or hailstorms. No pulp is dried at the factory, the most of it being fed to sheep and cattle. The company is beginning experiments on waste molasses mixed with pulp for feeding purposes. The factory opened October 2 and closed January 5.

LOGAN.—The Amalgamated Sugar Company is operating a sugar plant at Logan of 600 tons capacity. On account of wet weather the early season was not favorable to planting. There was no damage from insect pests or plant diseases. The pulp produced by this factory is sold to farmers for feeding, and molasses is shipped to eastern farmers for feeding.

OGDEN.—At Ogden a plant of 400 tons capacity is operated by the Amalgamated Sugar Company. The early season was not favorable to planting, but it changed for the better during the growing season. The pulp from this factory is sold to local farmers, and the molasses is shipped to eastern feeders. The factory opened its campaign September 12 and closed January 15.

LEWISTON.—The Lewiston Sugar Company is operating a plant at Lewiston of 600 tons capacity. The early season was unfavorable on account of wet weather. During the growing season better condi-

tions prevailed. Some little damage was done by hailstorms and floods. The pulp is used by local farmers for feeding, and molasses is shipped East and used for feeding purposes.

WASHINGTON.

WAVERLY.—A sugar factory was established at Waverly of 500 tons capacity in 1899. There are many other places in the State well adapted to this industry. Up to the present sugar beets have been grown by rainfall. Most of the new projects for building factories involve irrigation. It is probable that some of these will materialize, and that this State will eventually engage more extensively in this industry. Climatic conditions were not favorable during the past season. The management of the plant at Waverly has made strenuous efforts to work out its problems and develop facilities. It has gradually improved conditions, and is now a well-established enterprise.

WISCONSIN.

During recent years there has been a remarkable development of the sugar industry in Wisconsin. Most of the soils in the State will grow sugar beets profitably. The most prevalent type is the clay loam with clay subsoil. Beets grown on this or the sandy loam are usually of high quality and yield well.

There are now in the State four factories. The first was established at Menomonee Falls, followed by others at Janesville, Chippewa Falls, and Madison.

Wisconsin is one of the leading States in creamery and dairy products. The people engage extensively in all kinds of live-stock breeding and feeding. This is very important to the sugar industry, as it furnishes a market for the by-products and maintains soil fertility.

Like Michigan, Wisconsin has an abundance of cheap "stump land," as at one time it was extensively engaged in the production of lumber. The forests have been removed, and something is required to bring the land into usefulness. The sugar industry is adapted to this purpose, and is under special consideration for this end. Railroads, which were needed in the lumber industry, are already established. What is needed now is some new line of agricultural industry which will give these roads freight business.

Especially throughout the Janesville and Madison districts, tobacco has been grown extensively. Tobacco requires as much care and labor as sugar beets. It is not desirable to grow either tobacco or beets on the same ground for many successive years. Both require special and careful tilth, and leave the soil in fine condition for succeeding

crops. It is found in these districts that each of these crops enters nicely into a rotation. When the sugar industry was first installed the tobacco-growing interests were fearful that beet growing would work to the detriment of this crop. Later it developed that the two crops were mutually helpful, and to-day there is harmony between the two interests.

MENOMONEE FALLS.—The Wisconsin Sugar Company is operating a factory of 500 tons capacity at Menomonee Falls, which was established in 1901. The early spring was unfavorable and the summer cold. This factory is not drying its pulp. The green pulp is consumed locally by dairy farmers. This plant has installed the Steffins process for extracting a portion of the sugar contained in the molasses. The campaign opened October 14, closed January 5.

CHIPPEWA FALLS.—The Chippewa Sugar Company is operating a plant at Chippewa Falls of 600 tons capacity. The season of 1907 was unfavorable. The spring was late and wet and the summer rather too cold for growing beets. No pulp is dried at this factory. Most of the product is fed locally to cattle and sheep. The molasses is sold to stock-food manufacturers. Dairying and stock feeding have increased wonderfully since the establishment of the plant. The campaign opened October 21 and closed December 22.

MADISON.—The United States Sugar Company is operating a plant of 600 tons capacity at Madison. The season was not favorable, being rather too wet in the early season and too cold during the growing months. This plant dries its pulp, and it is shipped to consumers. It also has the Steffins process, by which it secures most of the sugar from waste molasses. During the past season the Lyons Saccharate process was installed to work on molasses with a view to securing the sugar contained therein.

JANESVILLE.—A factory of 600 tons capacity was established at Janesville, operating under the Rock County Sugar Company. The season was late, cold, and wet. Most of the beets were planted the latter part of May, some as late as June. During June and July there was a great deal of rain which hindered cultivation in the fields and promoted the growth of weeds and grass. During August and most of September the weather was favorable. In the latter part of September it was cold, retarding the growth of the crop. The beet crop was not damaged by insects or hailstorms. The beets produced gave good tonnage. The average sugar content was 15 per cent and the average purity 84. This factory dries all its pulp, for which it has a good market. It could sell at a profit considerably more than it produces. This dried pulp is shipped to dairy districts, as it is especially

adapted to milk production. In this particular locality the beet tops are quite heavy, and are one of the principal by-products of the sugar industry. The company is now increasing the capacity of the plant, both for sugar producing and storage, preparatory for the next campaign.

STATISTICS OF THE SUGAR INDUSTRY.

Under this heading I include (1) statistical data which I have gathered relating to the beet-sugar industry in the United States; (2) statistics of the world's production of sugar (both cane and beet) as compiled by Willett and Gray; and (3) some miscellaneous sugar statistics.

STATISTICS OF THE BEET-SUGAR INDUSTRY IN THE UNITED STATES.

The acreage planted to sugar beets in the United States in 1907, together with the percentage abandoned owing to unfavorable weather conditions, mistakes of growers, or other causes, is shown in the following table:

TABLE I.—*Acreage planted to beets in 1907.*

State.	Planted.	Abandoned.	State.	Planted.	Abandoned.
	Acres.	*Per ct.*		*Acres.*	*Per ct.*
California	52,823	10.3	Wisconsin	13,800	14.2
Colorado	134,848	5.3	Ten other States	45,197	9.0
Idaho	29,051	10.7			
Michigan	95,302	7.3	The United States	400,953	7.5
Utah	29,932	4.2			

Comparison with the acreage harvested shows that about 30,000 acres, or 7½ per cent, of the acreage planted was abandoned. Comparison with the figures for the preceding year shows that the acreage planted exceeds that for 1906 by 3,338 acres, while the acreage harvested is about 5,000 less, the acreage abandoned in 1906 being only 5.2 per cent. The increased loss of acreage was due mainly to unfavorable spring weather, particularly in Wisconsin, Nebraska, Idaho, and California.

GENERAL FACTORY AND FARM RESULTS.

In collecting and compiling the data which appear in the following table I have followed the same plan as for several years past. The data has been received directly from the factory managements, which are indeed the only source from which authentic statistics of this character can originate. The factory managements this year have

all reported the results of the year's operations with considerable fullness. In a very few cases where the information furnished was incomplete, it has been supplemented by careful estimates. It can be said, however, that the important data are wholly official. To avoid giving publicity to the business affairs of the individual concerns, only totals and averages by States are given for those States having more than one factory, while the results for the ten States each having only a single factory have been thrown together.

TABLE II.—*General factory and farm results.*

BY STATES, FOR 1907.

State.	Factories in operation.	Area harvested.	Average yield of beets per acre.	Beets worked.	Sugar manufactured.		Estimated average extraction of sugar.	Average sugar in beets.	Average purity coefficient of beets.	Average length of campaign.
					Pounds.	Tons.[a]				
		Acres.	*Tons.*[a]	*Tons.*[a]			*P. ct.*	*P. ct.*		*Days.*
California	8	47,387	10.23	484,816	146,045,500	73,023	15.06	17.9	85.1	73
Colorado	16	127,678	11.93	1,523,303	338,573,000	169,286	11.11	15.3	81.5	127
Idaho	4	25,938	9.41	244,080	75,928,200	37,964	15.55	17.8	88.3	88
Michigan	16	88,334	7.89	696,785	169,452,000	84,726	12.16	15.1	84.7	70
Utah	5	28,663	12.32	353,159	88,973,500	44,487	12.60	16.3	86.0	116
Wisconsin	4	11,837	10.37	122,800	30,320,000	15,160	12.35	15.1	85.6	61
States having but a single factory:[b] Illinois, Iowa, Kansas, Minnesota, Montana, Nebraska, New York, Ohio, Oregon, Washington	10	41,147	8.33	342,928	77,964,230	38,982	11.37	15.1	82.3	70
Totals and averages.[c]	63	370,984	10.16	3,767,871	927,256,430	463,628	12.30	15.8	83.6	89

TOTALS AND AVERAGES, BY YEARS, 1901–1906.[d]

		Acres.	*Tons.*[a]	*Tons.*[a]	*Pounds.*	*Tons.*[a]	*P. ct.*	*P. ct.*		*Days.*
1906	63	376,074	11.26	4,236,112	967,224,000	483,612	11.42	14.9	82.2	105
1905	52	307,364	8.67	2,665,913	625,841,228	312,921	11.74	15.3	83.0	77
1904	48	197,784	10.47	2,071,539	484,226,430	242,113	11.69	15.3	83.1	78
1903	40	242,576	8.56	2,076,494	481,209,087	240,604	11.59	[e]15.1	(*f*)	75
1902	46	[g]216,400	8.76	1,895,812	436,811,685	218,406	11.52	[e]14.6	[e]83.3	94
1901	36	175,083	9.63	1,685,689	369,211,733	184,606	10.95	14.8	82.2	88
Averages 1901–1906		252,547	9.66	2,438,593	560,754,027	280,377	11.50	15.0	82.8	86

[a] Tons of 2,000 pounds each.

[b] Grouped together to avoid giving publicity to the data of individual factories.

[c] The average yield of beets per acre is found by dividing the total beets worked by the total acreage harvested; the average extraction by dividing total sugar produced by total beets worked; the average contents of sugar, coefficients of purity, and length of campaigns by adding the figures reported by the different factories and dividing by the number of factories reporting.

[d] Compiled from the annual reports on Progress of the Beet-Sugar Industry in the United States.

[e] These averages are not based on data for all the factories, as some of them failed to report results of tests, but it is believed that they fairly represent the average character of the total beet crops.

[f] No data reported.

[g] Based on reports from 27 factories and careful estimates for 15 others.

If we compare the results for 1907 with the results for any previous year except 1906, or with the six-year averages, it appears that the industry has made an excellent showing, the comparison being in favor of last year in every particular. If, however, we compare the results with those for 1906, it appears that the industry has not quite held its own; but it should be borne in mind that the results achieved in 1906 were remarkable in almost every way. Speaking of these results in my report for last year I said: "The striking feature of the results for 1906 is the immense gain made, the enormous stride taken by the beet-sugar industry. In nearly all respects the year has been a record breaker." The fact that the industry as a whole did nearly as well in 1907 certainly indicates its stability.

The number of factories in operation, 63, is exactly the same as in the preceding year. The decrease in acreage harvested was only 1⅓ per cent, while the acreage planted was, as already stated, slightly greater than in 1906.

YIELD OF BEETS.

The total quantity of beets worked by the factories was 11 per cent less than in 1906, but was 54 per cent greater than the average for six years (1901–1906). The yield of beets averaged 10.16 tons per acre, being exceeded only in two previous seasons—1904 and 1906—and being 5 per cent greater than the six-year average.

QUALITY OF BEETS AND YIELD OF SUGAR.

The amount of sugar produced depends primarily on (1) the quantity of beets worked, (2) the character or quality of the beets, and (3) the extraction of sugar by the factory.

The most remarkable feature of the statistical data for 1907 is the high percentage of sugar in the beets and high purity coefficients. The figures for all previous years have been exceeded. In content of sugar, the highest average for any previous year was 15.3 per cent for 1904 and 1905; the average for six years—1901–1906—was 15 per cent; but the average for 1907 is 15.8 per cent.

The highest average purity coefficient for any previous year was 83.3; the average for the six-year period was 82.8; but the average for 1907 was 83.6. This record is all the more remarkable in view of the fact that the average yield of beets per acre was comparatively high. The effect of this high quality of the beets is shown distinctly in the high yield of sugar. While the total tonnage of beets was 11 per cent less than in 1906, the total sugar produced from the beets was only 4⅛ per cent less than in 1906.

The total quantity of beet sugar produced was 463,628 short tons, this being 67 per cent more than the annual average for the previous six years.

EXTRACTION OF SUGAR.

It is impossible for a sugar factory to secure and transform into marketable sugar all the sugar contained in the beets worked. Hence the percentage extracted is somewhat lower than the percentage which represents the sugar content of the beets, the difference representing the small amount of sugar left in the pulp and the much larger amount that can not be recovered from the molasses. The total loss of sugar ranges from 2½ to 4½ per cent of the weight of the beets, the variation depending somewhat on the purity of the beets, but more largely on the processes used in the factory and efficiency in factory operation.

The percentage of extraction (based on total weight of beets) in 1907 exceeded that of any previous campaign. The highest previous average was 11.74 per cent in 1905; the average for the six-year period (1901–1906) was 11.5 per cent; but the average for last year was 12.3 per cent. While this gain has resulted mainly from the higher average sugar contents of the beets worked, it also indicates increased efficiency in factory operation.

Percentages of extraction are not reported by the factory managements, but are calculated from their reports on tonnage of beets worked and total product of sugar. It is not uncommon for factories to hold over a quantity of molasses which is subjected to improved processes for the recovery of the sugar it contains. In this way it may happen that a considerable quantity of sugar is included in the results of a given campaign which really comes from the beets worked in the preceding campaign. While it is evident that the results of this practice may make the percentage of extraction calculated for certain factories for a given year slightly higher or lower than the actual, it can have no general or permanent effect. It is believed, therefore, that the high general average for 1907 can be accepted as representing the facts.

LENGTH OF CAMPAIGNS.

The period during which a factory is in actual operation is popularly known as the "campaign." The length of a factory's campaign depends, of course, on the total crop of beets and the factory's slicing capacity. The average length of campaign in 1907—eighty-nine days—was greater than in any previous year except 1906, when it was one hundred and five days.

COMPARISON BY STATES.

California, which held first place in the production of sugar in 1902, and second place in 1905 and 1906, fell to third place in 1907, not because of any decided falling off in production, but because of the

industry's growth in other States. In fact the industry appears to be just about holding its own in California. In quality of beets produced the State has always held first place, and this year its lead is more decided than ever. The average percentage of sugar in the beets, 17.9, is remarkable; indeed, a few years ago it would have appeared incredible. But the record made by some of the individual factories is simply phenomenal. In the Los Alamitos district the entire crop as delivered to the factory averaged 19.3 per cent sugar, with an average purity coefficient of nearly 85. In the Betteravia district the sugar content averaged 19 per cent and the purity coefficients 89.1. These records are by far the highest ever made by factory districts in the United States, and it is doubtful if they have ever been equaled in any country of Europe.

Colorado has led all the other States in production of beets and of sugar for several years, and this year its lead is more decided than ever before, its total crop of beets being more than double, and its product of sugar about double, that of Michigan, its nearest rival. In tonnage of beets per acre, Colorado, as usual, stands near the head of the list.

Michigan for several years led all other States in number of factories, and for a time it appeared destined to become the leading State in the development of the industry. In number of factories operated it still leads all States except Colorado, which it equals. In 1907 it held second place in acreage, tonnage of beets, and quantity of sugar produced. In yield of beets per acre it is, however, as it has been for several years, the lowest among the leading beet-growing States.

Utah, with 5 factories, holds fourth place in production, but last year, as in 1906, it led all other States in yield of beets per acre, the average for 1906 being nearly 16 tons per acre harvested, and for the past year 12⅓ tons. In sugar content and purity the beets grown in 1907 were excellent.

Idaho, with 4 factories, though but newly embarked in the industry, has risen to fifth place as a producer of beets and sugar. In sugar content of the beets last year Idaho almost equaled the phenomenal record made by California, and the average coefficient of purity, 88.3, exceeded anything on record in this country.

The results for Wisconsin, which has 4 factories and occupies sixth place, are remarkable only for the high quality of the beets. Small acreage is the evident explanation of the comparatively small production of beets and sugar.

The average results for the 10 States each having a single factory show no remarkable features. It is evident that these factories do not produce on an average as much sugar as the factories in the leading States. The 10 factories worked fewer beets and produced

less sugar in 1907 than 5 factories of Utah. The averages for sugar content, purity, and extraction of sugar, however, are very satisfactory.

PRODUCTION OF BEET SUGAR AND CANE SUGAR COMPARED.

It is interesting to note the progress of the beet-sugar industry as compared with the cane-sugar industry of the United States, as shown in the following table:

TABLE III.—*Production of cane sugar and beet sugar in the United States, 1902–1907.*

[In tons of 2,000 pounds.]

Year.	Cane sugar.	Beet sugar.
1902	368,733	218,406
1903	278,070	240,604
1904	392,000	242,113
1905	383,040	312,921
1906	272,160	483,612
1907	388,640	463,628

With the exception of about 12,000 tons produced annually in Texas, all the cane sugar produced in the United States (exclusive of the insular possessions) is made in Louisiana. While the production of cane sugar appears to be just about holding its own from year to year, the production of beet sugar has considerably more than doubled in six years. In fact the production in 1907 in Colorado alone was almost half as great as the production of cane sugar in Louisiana.

THE WORLD'S PRODUCTION OF SUGAR.

The following table shows the production of sugar in all the sugar-producing regions of the world for the years 1903–1907. The total cane sugar produced is greater than in any previous year except 1906, the falling off in 1907 being 127,000 tons. The total beet sugar produced is less by 227,000 tons than in 1905, and less by 163,000 tons than in 1906. These reductions, both in cane and beet sugar, are trifling compared with the grand total of about 7 million tons produced. The total production falls below that of 1906 by 290,000 tons, or 2 per cent.

TABLE IV.—*Sugar production of the world.*[a]

[Prepared in the Division of Foreign Markets, Bureau of Statistics.]

Country.	1903–4.	1904–5.	1905–6.	1906–7.	1907–8.
CANE SUGAR.					
United States:	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Louisiana and Texas	248,277	350,000	342,000	243,000	347,000
Hawaii	328,103	380,576	383,225	342,871	420,000
Porto Rico	130,000	145,000	213,000	210,000	217,000
Total United States[b]	706,380	875,576	938,225	845,871	984,000
Cuba	1,040,228	1,163,258	1,178,749	1,427,673	1,200,000
Other West Indies	268,306	244,837	302,163	279,631	291,000
Mexico	107,547	107,038	107,529	108,000	115,000
Central America	21,450	19,768	18,516	19,000	19,000
South America	601,134	590,382	700,001	610,151	586,000
Total America	2,745,045	3,000,859	3,245,183	3,290,326	3,195,000
Asia	2,876,671	3,333,672	2,926,209	3,455,446	3,481,477
Africa	355,747	251,340	317,967	349,000	270,000
Oceania	163,328	216,213	230,000	249,000	276,000
Europe	28,000	18,592	15,722	16,400	11,000
Total cane-sugar production	6,168,791	6,820,676	6,735,081	7,360,172	7,233,477
BEET SUGAR.					
United States	214,825	216,173	279,393	431,796	413,954
Canada	6,710	8,034	11,419	11,367	7,943
Total America	221,535	224,207	290,812	443,163	421,897
Europe:					
Germany	1,927,681	1,598,164	2,415,136	2,238,000	2,135,000
Austria-Hungary	1,167,959	889,373	1,509,870	1,344,000	1,460,000
France	804,308	622,422	1,089,684	756,000	725,000
Russia	1,206,907	953,626	968,000	1,470,000	1,410,000
Belgium	209,811	176,466	328,770	283,000	235,000
Netherlands	123,551	136,551	207,189	181,000	175,000
Other countries	441,116	332,098	415,000	445,000	435,000
Total Europe	5,881,333	4,708,700	6,933,649	6,717,000	6,575,000
Total beet-sugar production	6,102,868	4,932,907	7,224,461	7,160,163	6,996,897
Total cane and beet sugar production	12,271,659	11,753,583	13,959,542	14,520,335	14,230,374

[a] In long tons, of 2,240 pounds, except in the case of European beet-sugar production, which has been retained in metric tons of 2,204.622 pounds, as originally estimated by Licht; United States beet-sugar data were obtained from reports of Department of Agriculture on the Progress of the Beet-Sugar Industry in the United States; other data from official statistics of various countries, and from Willett and Gray.

[b] Not including the Philippine Islands, which are included under Asia.

MISCELLANEOUS SUGAR STATISTICS.

The following tables are made up of data taken mainly from the publications of Willett and Gray.

CONSUMPTION OF SUGAR IN THE UNITED STATES.

The following table shows the quantities of imported sugar (both cane and beet) consumed in this country during the past three years, the quantity of domestic cane, beet, and maple sugars, and the quantities of sugar made in this country from imported molasses. Of the total quantity consumed in 1907, nearly 80 per cent was imported either from foreign countries or the insular possessions of the United States, while less than 13 per cent was domestic beet

sugar. The total annual consumption has nearly reached 3 million long tons.

TABLE V.—*Consumption of sugar in the United States, 1905–1907.*[a]

[According to Willett and Gray, January 9, 1908.]

Kind and origin.	1907.	1906.	1905.
Cane and beet sugar from foreign countries and insular possessions	*Tons.*[a] 2,337,352	*Tons.*[a] 2,281,599	*Tons.*[a] 2,056,092
Cane sugar, Louisiana and Texas	264,968	267,947	334,522
Beet sugar, United States	375,410	300,317	220,722
Maple sugar	10,000	6,000	9,000
Molasses sugar, made in United States from foreign molasses	6,249	8,150	11,880
Total domestic sugar	656,627	582,414	576,124
Total consumption of all sugars	2,993,979	2,864,013	2,632,216

[a] Tons of 2,240 pounds.

The total annual consumption of sugar in the United States, the percentage of increase or decrease year after year, and the per capita consumption for the years 1884–1907 are shown in the table which follows. The total consumption has increased nearly 140 per cent while the per capita consumption has increased over 52 per cent since 1884.

TABLE VI.—*Consumption of sugar in the United States for twenty-four years, 1884–1907.*

[According to Willett and Gray.]

Year.	Total amount sugar consumed.	Increase (+) or decrease (−).[a]	Consumption per capita.	Year.	Total amount sugar consumed.	Increase (+) or decrease (−).[a]	Consumption per capita.
	Tons.[b]	*Per cent.*	*Pounds.*		*Tons.*[b]	*Per cent.*	*Pounds.*
1884	1,252,366	+ 7.01	51.00	1896	1,940,086	−0.49	60.90
1885	1,254,116	+ 0.14	49.95	1897	2,070,978	+6.75	63.50
1886	1,355,809	+ 8.11	52.55	1898	2,002,902	−3.29	60.30
1887	1,392,909	+ 2.74	53.11	1899	2,078,068	+3.75	61.00
1888	1,457,264	+ 4.62	54.23	1900	2,219,847	+6.83	66.60
1889	1,439,701	− 1.21	52.64	1901	2,372,316	+6.87	69.70
1890	1,522,731	+ 5.77	54.56	1902	2,566,108	+8.17	72.80
1891	1,872,400	+22.96	67.46	1903	2,549,642	−0.64	70.90
1892	1,853,370	− 1.02	63.76	1904	2,767,162	+8.53	75.30
1893	1,905,802	+ 2.83	63.83	1905	2,632,216	−4.88	70.50
1894	2,012,714	+ 5.55	66.64	1906	2,864,013	+8.81	76.10
1895	1,949,744	− 3.13	64.23	1907	2,993,979	+4.54	77.54

[a] As compared with the preceding year. [b] Tons of 2,240 pounds.

Although in recent years the beet-sugar industry has made great strides in the United States, and there has been some growth of the cane-sugar industry, the increase in production has not by any means kept pace with the increase in consumption. In fact we are consuming a good deal more foreign sugar than we did ten years ago. In 1897 our total consumption of sugar was 2,070,978 long tons; in 1907 it was 2,993,979 tons, an increase in ten years of 923,000 tons. During the same period the increase in domestic production has been only about 350,000 tons.

SUGAR IMPORTED FOR CONSUMPTION.

The next table shows the character of the sugar imported for consumption, and its origin. Nearly 85 per cent of the sugar imported comes from Hawaii, Porto Rico, the Philippines, and Cuba under tariff concessions, while only about 15 per cent comes from other countries and pays full duty. The imports from both Porto Rico and Cuba are steadily increasing, Cuba alone furnishing about 58 per cent of the foreign sugar consumed in the United States in 1907, and about 45 per cent of the total sugar consumed. It will be noticed that nearly all the imported sugar consumed in the United States is made from cane; in 1906 less than 8 per cent was from beets, and in 1907 less than 1 per cent. In fact if we include the sugar made in the United States, it appears that only about 13 per cent of the sugar we consumed in 1907 was made from beets.

TABLE VII.—*Consumption of imported sugar, 1905–1907.*

[According to Willett and Gray.]

Kind and origin.	1907.	1906.	1905.
Imports on which tariff concession is allowed:[b]	*Tons.*[a]	*Tons.*[a]	*Tons.*[a]
From Hawaii, cane sugar	418,102	343,857	376,497
From Porto Rico, cane sugar	212,853	193,978	124,928
From Philippines, cane sugar	10,700	41,900	14,673
From Cuba, cane sugar	1,340,400	1,165,994	1,101,611
Total	1,982,055	1,745,729	1,617,709
Imports on which full duty is assessed:[c]			
Foreign sugar—			
Raw cane	347,509	357,057	412,560
Raw beet	6,780	175,827	22,161
Refined beet	949	2,734	1,844
Refined cane	59	252	1,818
Total	355,297	535,870	438,383

[a] Tons of 2,240 pounds.
[b] Sugar from Hawaii and Porto Rico is admitted free of duty; that from the Philippines at 25 per cent below the regular rate, and that from Cuba, under the reciprocity treaty, at 20 per cent less than the regular rate.
[c] The regular rates of duty on raw sugar vary from 95 cents to $1.75½ per hundred pounds, depending on the character of the product; the regular rate on refined sugar is $1.95 per hundred pounds.

SUGAR REFINING.

The following table shows that, as a rule, less than 5 per cent of the sugar consumed in the United States is used in a raw or unrefined state, while more than 95 per cent is refined. It also shows that about one-half the refined sugar is turned out by the American Sugar Refining Company, about three-eighths by the independent refineries, about one-tenth by the American beet-sugar factories, and only a small fraction of 1 per cent by the foreign refineries. In fact, owing to the higher rate of duty on imports of refined sugar, practically all the sugar imported comes in the raw state and is refined in this country.

TABLE VIII.—*Consumption of refined and raw sugar in the United States, and quantities of sugar refined by different classes of refiners, 1905–1907.*

[According to Willett and Gray.]

	Quantity of sugar.			Percentage refined.		
	1907.	1906.	1905.	1907.	1906.	1905.
Refined sugar, manufactured by—	*Tons.a*	*Tons.a*	*Tons.a*	*Per cent.*	*Per cent.*	*Per cent.*
American Sugar Refining Co...	1,401,061	1,468,503	1,325,692	49.27	51.03	52.89
Independent refiners.....	1,064,827	1,031,831	939,557	37.44	37.38	37.48
Beet-sugar factories.....	375,354	300,059	220,477	13.19	10.87	8.79
Hawaiian cane-sugar factories..	1,674	16,964	17,292	.06	.61	.69
Foreign refiners.....	1,008	2,986	3,662	.04	.11	.15
Total.....	2,843,928	2,760,343	2,506,680	100.00	100.00	100.00
Sugar consumed in raw state.....	150,051	103,670	125,536	.....	.....	.....

a Tons of 2,240 pounds.

CONSUMPTION OF SUGAR IN EUROPE.

Mr. F. O. Licht, a high authority on European beet-sugar statistics, in a report dated February 21, 1908, estimates the per capita consumption of sugar in European countries as follows:

TABLE IX.—*European per capita consumption of sugar for the year 1906–7.*

	Pounds.		Pounds.
Germany.....	40.92	Portugal and Madeira.....	15.51
Austria.....	24.32	England.....	93.50
France.....	36.05	Bulgaria.....	7.98
Russia.....	20.55	Greece.....	10.16
Holland.....	41.40	Servia.....	6.92
Belgium.....	29.70	Turkey.....	11.73
Denmark.....	73.68	Switzerland.....	55.22
Sweden and Norway.....	47.88		
Italy.....	7.63	All Europe.....	31.61
Roumania.....	7.83	United States *a*.....	77.54
Spain.....	11.37		

The foregoing table shows that we are greater consumers of sugar in the United States than any other nation except England, and that we consume more than two and a half times as much as the people of Europe on an average.

BEET SUGAR PRODUCTION IN EUROPE.

The following is an estimate by Licht of the production of beet sugar in Europe during the last six campaigns:

TABLE X.—*Beet-sugar production in European countries, 1902–3 to 1907–8.*

	1907–8.	1906–7.	1905–6.	1904–5.	1903–4.	1902–3.
	Tons.b	*Tons.b*	*Tons.b*	*Tons.b*	*Tons.b*	*Tons.b*
Germany.....	2,135,000	2,238,000	2,415,136	1,598,164	1,927,681	1,762,461
Austria.....	1,460,000	1,344,000	1,509,870	889,373	1,167,959	1,057,692
France.....	725,000	756,000	1,089,684	622,422	804,308	833,210
Belgium.....	235,000	283,000	328,770	176,466	209,811	224,090
Holland.....	175,000	181,000	207,189	136,551	123,551	102,411
Russia.....	1,410,000	1,470,000	968,000	953,626	1,206,907	1,256,311
Other countries.....	435,000	445,000	415,000	332,098	441,116	325,082
Total.....	6,575,000	6,717,000	6,933,649	4,708,758	5,881,333	5,561,257

a According to Willett and Gray. *b* Tons of 2,240 pounds.

The foregoing table shows the enormous proportions to which the beet-sugar industry has developed throughout central Europe and especially in Germany, Austria, and Russia. Though, as already stated, cane sugar heavily predominates in the consumption of America, exactly the reverse is true in Europe.

DEVELOPMENT OF CONDITIONS AND PROSPECTS FOR EXTENDING THE BEET-SUGAR INDUSTRY.

CALIFORNIA.

There are a number of places in California where conditions are favorable for the establishment of the beet-sugar industry.

CORCORAN.—At Corcoran a 600-ton plant is under construction. Beets will be grown for its first campaign in 1908.

EL CENTRO.—A large company, known as the Imperial Sugar Company, capitalized for $3,000,000, is planning to erect an 800-ton plant at El Centro, in San Diego County.

SANTA ANA.—There is a project under headway for establishing a sugar factory at Santa Ana of 500 tons capacity, and its consummation appears probable.

COLORADO.

BERTHOUD.—A factory is under contemplation at Berthoud with a capacity of 750 tons. The following letter outlines the conditions and prospects at that place:

BERTHOUD, COLO., *July 15, 1907.*

DEAR SIR: We have secured contracts for the growing of 6,000 acres of beets for five years at $5 per ton. This acreage can be increased if necessary. We have an ample supply of water for irrigation, and our town has recently installed a complete waterworks system, furnishing an abundance of filtered water.

Our farmers are expert beet raisers, having grown beets for the last seven years, which have been sold to the Great Western Sugar Company. This company is unable to erect sufficient factories to handle the beet crop. Our farmers desire to raise more beets, as they find it a profitable crop. We have raised as high as 35 tons to the acre, and a 20-ton average is no unusual thing. We desire to interest capital in our project.

Respectfully,

D. M. MAY,
President Berthoud Beet Growers' Association.

DELTA.—With reference to a project now under consideration at Delta, I clip the following from the Glenwood Springs (Colo.) Post of March 14, 1908:

A Delta dispatch Friday night says: News reached here by telegram from New York this afternoon that Delta is to have one of the finest sugar factories in the State of Colorado. It will cost nearly $1,500,000 and is to be built by New York, St. Louis, and Kansas City capital.

The Business Men's Association has been working hard for the factory, and the message to-day states that its efforts have not been in vain. The company back of the affair is known as the Surety Sugar and Land Irrigation Company, and the tele-

gram states that the company has put up its $100,000 bond as a guaranty that the project will be carried out.

The company is incorporated for $2,500,000, divided into 25,000 shares of $100 a share. Work will be started soon, and the factory is expected to be completed within about a year.

Delta has pledged a 50-acre location for the factory and must take $100,000 of the capital stock. Six thousand acres of sugar beets have been pledged. This company agrees to pay a flat rate of $5 a ton for beets for three years.

JULESBURG.—Sugar beets have been grown quite extensively for several years in the vicinity of Julesburg. Conditions have been pretty thoroughly determined at this place. It has excellent facilities, and everything appears favorable for installing the sugar industry.

I insert a copy of a letter from Mr. Mark Burke, who has given the subject of sugar beets considerable attention and has made many yearly reports with reference to the prospects at this place:

JULESBURG, COLO., *February 15, 1908.*

DEAR SIR: We have grown beets successfully for five years. Tonnage ranges from 10 to 18 tons per acre. We never could get a test of the beets except once (from American Sugar Company), and then they showed over 18 per cent sugar.

We have 28,000 acres of good beet land under a storage reservoir, the capacity of which is 1,230,000,000 cubic feet, three large ditches for distribution, and a source of water supply that can never fail. There are two lines of railroad through the district, with facilities for loading at a distance not greater than 4 miles from any land in the district. We can guarantee to supply a 1,200-ton factory for five years, beginning with 1909. Farmers would be glad to raise beets if we had a factory here, but are tired of waiting for cars in the fall to ship to other factories.

Yours, truly, MARK BURKE.

FOUNTAIN.—I insert a report made by Edward Van Asmus with reference to conditions near Fountain. A sugar factory has been under contemplation for some time, and conditions there are well adapted for the industry:

FOUNTAIN, COLO., *March 3, 1908.*

DEAR SIR: Replying to your favor of the 13th ultimo, we had about twenty-five different growers of sugar beets this year. The area amounted to about 400 acres. The average yield was 14 tons. All the beets were contracted and sold to the sugar factory located at Swink, Colo.

Our prospects for a sugar factory are such that we can have one any time we wish it.

Yours, truly,

EDWARD VAN ASMUS.

MONTROSE.—Montrose has been considered a favorable locality for building a sugar factory. Its conditions are well adapted to the sugar industry. A considerable acreage of beets has been grown here for the factory at Grand Junction, Colo. The prospects for establishing a factory at this point in the near future appear quite favorable. The following letter is from the president of the commercial association organized at this place:

MONTROSE, COLO., *February 22, 1908.*

DEAR SIR: The prospects for building a sugar factory at Montrose are fair, but, while we make a splendid showing in both beets and percentage of sugar, our acreage is but

about 1,000 as yet. At present our farmers are shipping to the plant at Grand Junction, 73 miles distant, and getting a flat rate of $5 on board cars here.

Our tonnage last year averaged 17½ to the acre. The sugar content was an average of 16½ per cent. The purity is between 90 and 94, but I have not the average figures from the factory. Individual areas yielded 20, 25, and 30 tons, and in one instance three-fourths of an acre, measured by disinterested parties, yielded at the rate of 37½ tons to the acre. Sugar content has run up to 22 and in one sample to 24 per cent.

Under the Gunnison tunnel, now being constructed by the Government to divert the waters of the Gunnison River into the Uncompahgre Valley, the outlet being near Montrose, there are, by Government survey, 150,000 acres of fine fertile soil, all of which is rich beet land, though much of it is the best orchard land in the world and therefore too costly for beet culture. This tunnel will be completed in one year and will water the entire valley. At present the acreage cultivated is but 30,000, and the water supply is from the Uncompahgre, but not sufficient even for the present acreage.

It is my opinion that, when the Gunnison tunnel, or "Uncompahgre project," as the Government calls it, is completed, there will be two sugar factories in Montrose County—one at Olathe and one at Montrose—as both localities are fine for beets.

We have several kinds of soil contiguous to Montrose: (1) The adobe soil, which is rich and very lasting, but hard to conquer; (2) the red or chocolate soil, the best fruit land known, also fine for beets; and (3) the gravel and sand loams of the river bottoms and slopes, which grows great yields of beets.

The average beet crop here brings the producer $90 per acre on the cars. Russian labor tills, waters, thins, and looks after the crop for $20 an acre, if desired. So the farmer plants the crop and then harvests it and hauls it to the cars as his share, and averages $70 an acre for his labor and land income.

Very truly, O. C. SKINNER.

OTHER PLACES.—Among other places mentioned in connection with the establishment of beet-sugar plants are Ault, Hillrose, Pueblo, Manzanola, and Wiley; and another factory at Holly is proposed.

IDAHO.

A number of places in Idaho have been thoroughly tested. This has been accomplished in the most practical way by growing beets for other factories in the State.

PAYETTE.—Everything indicates that a factory of 600 tons capacity will be built at Payette. This district has grown a large acreage for the factory at Nampa. The yield is good and the beets of high quality. It is said that the Utah-Idaho Sugar Company is under contract with local business men to build a factory at Payette for the campaign of 1908.

I insert here a letter from William McOmie in regard to conditions and prospects at this place:

PAYETTE, IDAHO, *March 7, 1908.*

DEAR SIR: Your letter reached me yesterday. I have charge of the agricultural work here for the sugar company. I will say there was 1,800 acres planted in what we call the Payette district in 1906, which lies on either side of the Snake River, partly in Idaho and partly in Oregon. The crop did so well and the farmers were so well satisfied that 4,400 acres were planted in 1907.

The two years were just the reverse of each other. In 1906 we had a very warm, wet spring and summer. In 1907 it was very cold and dry. Getting the reverse in climatic conditions, and the beets doing well both seasons where the soil was handled right, proves beyond all doubt the success of the industry in the Payette Valley.

There were many growers who realized $70 per acre net in 1906, and several who cleared above all expenses, in 1907, $40. But last year was much more unfavorable in the spring for starting the young plants, and unless a grower had his soil well fertilized and the moisture well protected he did not realize as he did when nature supplied what was needed the year before.

The sugar content was fairly good, though not as good as it would have been had not so many of the young plants been stunted. The average percentage of sugar in the beet would be about 14 per cent with a purity of 83.

As to the cost of production, it largely depends on the way the grower manages his business. The hand labor cost is $20 per acre for an average tonnage of 12 tons. This includes blocking and thinning, hoeing, pulling, topping, and loading into the wagons during the season. This work was largely done by Japanese. The team work or the labor done by the farmer will vary from $10 to $15 per acre, about $12.50 being an average.

The people of Payette Valley want a factory and will undoubtedly get one before very long. In fact, our company has promised to build just as soon as conditions will justify.

The average tonnage last year at this point was 9 tons to the acre; in 1906 it was over 12.

Very respectfully, WM. MCOMIE.

BOISE.—Capitalists have under consideration the construction of a factory at Boise, the State capital.

ILLINOIS.

ELGIN.—Business men and capitalists of Elgin have been considering the sugar industry during the past season, as is shown by the following letter.

ELGIN, ILL., *February 19, 1908.*

DEAR SIR: We have the assurance, that of a reliable concern, to put up a sugar plant at this place, providing the farmers in the locality will agree to raise at least 3,000 acres of sugar beets. The industry is new in this locality, last year being the first that sugar beets were raised. There were about 250 acres planted. The yields were from 12 to 20 tons per acre. The sugar contents ran from 14½ to 17½ per cent, with a very high purity.

Very respectfully, C. G. HEINE.

IOWA.

There are many places in this State well adapted to the sugar industry. During the past season in the vicinity of Fort Dodge about 200 acres of beets were grown for the factory at Waverly. These were grown under the direction of an expert. The season was very unfavorable for any crops on account of the excessive rain. Sugar beets, like other crops, suffered from the unfavorable climatic conditions, but in comparison the beet crop held its own. Fort Dodge and Waterloo are situated close enough to Waverly to be influenced by conditions developed by the factory at this point.

KANSAS.

There are a number of places in the vicinity of Garden City where the advisability of establishing a beet-sugar plant is under consideration. It is said that the company operating the factory at Garden City has in view the development of sufficient lands along the same irrigation ditch to enable them to install four more plants. It is apparent that other plants will be installed in Kansas in the near future.

MICHIGAN.

There are a number of places in Michigan where the building of sugar factories is under consideration.

MOUNT PLEASANT.—Some time ago a plant was started at Mount Pleasant. Work ceased before it was completed. It seems quite probable now that this plant will be completed for the campaign of 1908.

MONTANA.

The sugar industry has played an important part in developing agricultural conditions in Montana. It has been an incentive to establishing irrigation facilities. There are many places in the State adapted to this industry.

BOZEMAN.—The Bozeman district has been very carefully investigated by a number of persons interested in the sugar industry. This place is the home of the agricultural college and the State experiment station, and conditions are well adapted to this industry.

With reference to conditions and the prospect of building sugar plants, I submit a report from E. S. Edsall, secretary of the Gallatin Valley Commercial Club at Bozeman:

BOZEMAN, MONT., *February 8, 1908.*

DEAR SIR: As to the prospects of building a sugar factory in the Gallatin Valley, I regret to say that just at this time the outlook is not encouraging. This project was taken up about two years ago for the first time, and after much work on the part of the parties having it in charge the acreage asked for by the syndicate was finally secured in the fall of 1906 or spring of 1907. They asked for 5,000 acres, and it was a hard matter to secure this amount within hauling distance of the proposed site, and the farmers were, of course, a little backward about undertaking it as a new proposition. However, the acreage was finally secured. The committee making this canvass, however, had promised the farmers that their contracts would not be surrendered to the sugar company until all arrangements had been made for the importation of the proper kind and amount of labor for cultivating and harvesting the beets. Laborers at that time were at a premium in this valley, and especially the kind of people required for this work. In spite of the fact that every available means was used to obtain labor, nothing could be guaranteed to the farmers, and the local promoters, having given their word in this matter, did not feel like releasing the contracts under these conditions. The matter was dropped after many trips east, west, and south in an effort to secure labor.

Yours, truly,

E. S. EDSALL, *Secretary.*

The following letter is from the director of the State agricultural experiment station:

BOZEMAN, MONT., *February 24, 1908.*

DEAR SIR: A little over a year ago considerable was done in this valley in the way of working up an interest in the sugar-beet question, and also in regard to the establishment of a beet-sugar factory in this valley. However, because of the inability to get the necessary laborers to do the hand work in connection with the sugar beets, the matter was dropped for the time being.

Another factory is being arranged for and I believe will be built in the northern part of the State, in the Milk River Valley, near the town of Harlem. It is expected that considerable of the beets for this factory will be grown on the Indian reservation.

The factory at Billings, which has a daily capacity of 1,200 tons, has completed a very successful second season, handling in the neighborhood of 9,000 acres of beets.

Very truly, yours,

F. B. LINFIELD.

CHINOOK.—The business men and farmers in the vicinity of Chinook have been very energetic for three or four years in promoting a beet-sugar factory. Some of the leading capitalists of the country who are interested in the sugar industry have given the place close investigation.

I submit a communication from A. W. Ziebarth, secretary and treasurer of the Beet Growers' Association of Chinook; also a table showing the sugar content and purity of beets that have been produced in the district:

CHINOOK, MONT., *February 21, 1908.*

DEAR SIR: The prospects are very good that the factory will be built and in operation for the season of 1909.

Beets have been grown experimentally for the past five years by a great many farmers in tracts of one-fourth to one-half acre.

I inclose a report of some analyses made during the past years and, in explanation of the sugar content of some of the samples, I wish to say that I believe the small percentage of sugar is due to the fact that these beets were pulled before fully matured.

Last season I had five samples analyzed: Nos. 3959, 3967, 3956, and 3980, and was careful to see that they were fully matured, and the result shows an average sugar content of 19.88 per cent and an average purity of 83.69.

We have very little information on tonnage, as no record was made except in a few instances where a tonnage of 21 to 23 tons per acre was raised.

We have about 30,000 acres of land under irrigation between Yantic, 10 miles west of Chinook, and Harlem, 20 miles east, all lying within easy hauling distance from the railroad. About three-fourths of this land is a sandy loam, the soil having a depth of 10 to 15 feet, and it is good sugar-beet land. The balance is rather heavy, being a gumbo. The source of irrigation is from Milk River and its tributaries.

Yours, truly,

A. W. ZIEBARTH.

Analyses of samples of sugar beets from Chinook, Mont.

ANALYSES MADE AT MONTANA EXPERIMENT STATION, BOZEMAN.

Lab. No.	Grower.	Average weight of beets.	Sugar in beets.	Coefficient of purity.	Condition.
		Ounces.	*Per cent.*		
781	O. R. Thornber	46.00	15.58	84.01	
782	O. R. Thornber	47.00	12.16	75.04	
2978	R. H. Clarkson	28.50	12.03	73.04	Good.
3391	W. O. Smotherman	21.00	16.63	84.01	Good.
3412	W. W. Cook	20.00	16.09	85.06	Good.
3413	W. W. Cook	68.00	10.62	73.03	Good.
3430	W. B. Sands	25.00	18.05	89.07	Wilted.
3441	R. H. Clarkson	21.05	18.06	90.04	Wilted.
3443	W. B. Sands	18.00	15.58	87.07	Good.
3450	Mrs. R. F. Morris	35.50	12.00	69.05	Wilted.
3462	John Clark	28.05	20.04	90.07	Good.
3463	Gust Stevens	11.06	19.07	92.01	Wilted.
3464	W. O. Smotherman	18.04	19.86	88.03	Good.
3465	A. H. Reser	64.03	14.02	84.02	Wilted.
3957	John Luse	40.00	16.40	80.80	
3967	John Clark	16.00	23.00	88.60	Wilted.
3965	W. B. Sands	34.67	20.90	84.90	
3956	W. D. Smotherman	26.67	20.60	87.10	
3980	J. J. Hallenberger	33.33	18.50	77.08	

ANALYSES MADE AT OGDEN, UTAH.

.....	R. H. Clarkson	.....	17.00	82.20
.....	Maurice Jones	.....	16.00	82.70
.....	Henry Bosch	.....	13.40	81.10
.....	W. B. Sands	.....	16.00	86.80
.....	R. Hermes	.....	13.20	82.50
.....	John Prosser	.....	14.20	81.30
.....	John Clark	.....	16.20	83.00
.....	W. D. Smotherman	.....	16.00	80.00

At Chinook, local interests have subscribed over $7,000 to carry on investigations and experiments. A local association has secured contracts from farmers to grow 3,000 acres of beets.

The average sugar content of beets grown in the locality last year was 16 per cent and the average purity coefficient 83. Irrigation has been developed to a considerable extent. Investments in these improvements are largely made by local landowners and farmers. The Winter-Anderson ditch supplies 2,000 acres; the Paradise ditch, 5,000 acres; the Harlem Ditch Company, 10,000 acres; the North Fork of the Milk River furnishes 10,000 acres. Chinook is in Chouteau County, and has been the center of a great cattle-grazing district.

CONRAD.—Another point under special investigation for some time is Conrad. The American Sugar Company, controlled by the Havemeyers, is interested to a considerable extent in Colorado. It represents the principal interest in the factory at Billings, and has been investigating conditions at Conrad.

HARLEM.—Harlem seems to have an excellent prospect for a factory. It is situated in Chouteau County, just outside of the Indian reservation, and within 3 miles of the Northern Pacific Railroad. A

spur will be built to this place to accommodate the factory. Local interests and capitalists have been working on this project for some time. It is the plan to use the Indians on the Fort Belknap Reservation as laborers to cultivate the beets. A special act of Congress was passed to carry through this project. Recently the principal investors in the Amalgamated Sugar Company of Utah, acting under the provisions of this new law, entered into a contract with the Government to lease 10,000 acres of Indian lands in this reservation.

I clip from the Salt Lake City (Utah) News of January 10, 1908, an account of the movement for establishing this plant at Harlem:

OGDEN, *January 10.*—A gigantic enterprise will soon be launched by Ogden capitalists, involving the building of a $1,000,000 sugar factory on the borders of the Fort Belknap Indian Reservation near the town of Harlem, in northern Montana.

After three years investigation and negotiation, aided by a special act of Congress, a contract for a lease was signed yesterday in this city.

The agreement, which is a lease of 10,000 acres of tribal lands in the Fort Belknap Reservation for a period of ten years, involves the outlay of $1,000,000 on a sugar plant immediately outside of the reservation, the construction of a three-mile railroad line and the inauguration of a system of irrigation starting from the Milk River, a stream that runs through the Indians' land and to the water of which they have prior claims. Work on the factory will be commenced in the fall, so that the factory will be completed for use in 1909, when the first crop of sugar beets is to be harvested by the Indians.

The educational value of the project can not be estimated until after a thorough test has been made, but it is a splendid chance for 1,400 healthy Indians.

The 10,000 acres of land to be used in the growing of beets lie in a very fertile valley within the Indian reservation, immediately joining the town of Harlem on the south.

I also submit a special report from W. E. French, of that place, giving further facts in relation to the establishment of this plant:

HARLEM, MONT., *February 4, 1908.*

DEAR SIR: The crop of beets is to be grown by the Indians in so far as they are capable, and in the event of their inability, the sugar company has the privilege of supplying other contract labor; but in any event the sugar company is compelled to pay for the crop at the rate of $4.50 per ton, the Indians receiving the entire benefit, less the expense of growing.

The contract for the erection of the factory will be let this summer and a start toward the building will be made this fall. The factory will be ready to receive the crop in 1909. The capacity of the factory will be 600 tons, but the machinery to be installed will be of sufficient capacity to allow double this tonnage.

The exact location of the factory has not as yet been decided, but it will be built within a radius of 3 to 12 miles east of Harlem, on Milk River.

While the sugar company is working the Indian lands, giving employment to many and acting somewhat as a school of instruction in sugar-beet culture, the white people will settle up by location and purchase those lands tributary to this reservation, and in due time, and after the expiration of this contract, will be able to supply the factory with all the beets it can handle.

Our soil is generally of the sandy loam nature and is considered a first-class soil for sugar beets.

Very truly, yours, W. E. FRENCH.

Further facts relating to conditions around Harlem are given in a letter from Thomas M. Everett:

HARLEM, MONT., *March 23, 1908.*

DEAR SIR: We have experimented very little in the raising of sugar beets; that is, we have not raised them in large quantities, but from the small patches planted for the last four years the results have been very flattering, one sample going as high as 28 per cent sugar with a purity of about 90. This sample was analyzed at our State fair by the chemist of the State Agricultural College and was, I believe, the best ever tested in the State. A few acres have made as high as 30 tons per acre; of course this is not an average, but the best I have heard of. I think the average yield has been about 20 tons of beets, with an average purity of about 90 and an average sugar content of about 17 per cent.

The soil of the Milk River Valley, in which we are located, is a very deep, dark soil, containing considerable sand, but much of it is what would be called gumbo, in which all root crops grow to perfection.

It has been thoroughly examined by the experts of the Amalgamated Sugar Company of Utah, who are going to build the factory, and they seem to have no doubt of its fitness for the sugar beet.

Yours, very truly, THOS. M. EVERETT.

DILLON.—The most recent proposition for a new sugar factory in Montana is at Dillon. Mr. Louis Penwell, of Helena, who is one of the principal owners of the Beaverhead Ranch Company, purchased the big Morris ranch, on Birch Creek. He is planning to cut up this ranch into small tracts, introduce settlers, and establish a beet-sugar factory.

NEBRASKA.

NORTH PLATTE.—At North Platte, in Lincoln County, a large acreage of beets has been grown for several years for the factories at Leavitt and Grand Island. It is quite probable that the factory at Leavitt will be removed to this place, or a new factory built in the next year or two. In Lincoln and surrounding counties beets have been grown to the extent of 11,000 acres for the season. Conditions favorable to sugar beets are well established.

UTAH.

Probably the history of no factory in operation in the United States better exemplifies the natural course of development than that of the factory at Lehi, which is among the oldest and most successful in the United States. For two or three years this factory did not receive sufficient beets to enable it to run at its full capacity. Gradually its supply of beets reached the maximum. Finally it was compelled to put in a slicing station to handle the beets grown some miles distant from the main plant, thereby increasing the sugar output of the main factory. In a short time another slicing station, and more recently a third, became necessary. In addition to this, in order to take care

of the beet-growing territory it had developed, this sugar company built a new modern plant at Garland, about 90 miles north of its location, and this plant has a working capacity equal to that of the original plant with its auxiliaries. While it was accomplishing this work, this company has also been promoting beet production in a large area in counties to the south, particularly Sevier and Sanpete, and has under consideration the establishment of another factory in this area.

An account of the situation in Sevier County is taken from the Salt Lake City Tribune of August 25, 1907, as showing the feeling in the district toward the beet-sugar industry:

F. B. Gould, beet field superintendent for Sevier County, furnished the Richfield Reaper with some interesting data regarding the sugar-beet industry in that county. The total number of acres contracted for planting this year is 1,224, against 882 for last year. This is an increase of nearly 40 per cent. With a little canvassing and soliciting among the farmers, it is very likely that the acreage could have been almost, if not quite, doubled. No effort was made for acreage this year, as the factory at Lehi is now supplied to its capacity. No encouragement whatever was given to new growers, and only a few were admitted to contracts this year. The acreage is divided among the various districts as follows: Monroe, 536; Richfield, 140; Joseph, 128; Elsinore, 101; Austin, 100; Vermilion, 100; Central, 68; Annabella, 38; Glenwood, 18.

The total tonnage of beets of Sevier County last year was 13,133 tons. Deducting 37 from the number of acres contracted, leaving 845 acres actually cultivated, the average yield was a little better than 15½ tons per acre. The crop brought $59,100 to the farmers of Sevier County, or a trifle less than $70 an acre. If the crop this year does as well as it did last season (and there is no reason to be divined at present why it should not) the total tonnage should be about 19,000 tons, representing nearly $80,000.

In regard to the siloing which the contracts call for this year, Mr. Gould said that that covered only 10 per cent of the crop. Twenty-five cents per ton additional is allowed for this work. Mr. Gould is of the opinion that this additional price will about cover the cost of siloing, as it is a simple process requiring very little extra labor. The beets are simply piled in shallow trenches and covered with beet tops. This will enable the growers to get all their beets out of the ground before the frost comes.

SOUTH DAKOTA.

South Dakota has been thoroughly tested by the State experiment station in conjunction with Government investigation. There are many places well adapted to the sugar industry, among which are Sioux Falls, Mitchell, Watertown, Brookings, Huron, and Aberdeen.

BELLE FOURCHE.—Recently, under the Reclamation Act, a large irrigation ditch was established at Belle Fourche. This place is located in Butte County, in the northwestern corner of the State. With reference to conditions and prospects for a sugar factory at this point, I submit a letter from R. F. Walter, Government engineer in charge; also a table showing the sugar contents of beets grown there:

BELLE FOURCHE, S. DAK., *February 28, 1908.*

DEAR SIR: The prospects for the building of a beet-sugar factory in this locality are excellent, and I have been informed by the capitalists that they are ready to build a factory here as soon as the water is ready to irrigate the land under the project. We will have about 12,000 acres under water this year, and probably 40,000 acres by another year, at which time they claim they will put in a factory.

We have had beets grown in small quantities here for two years by 20 or 30 farmers. Although they did not give the beets the care they should have, they secured fair results. I send you herewith a table showing the sugar contents of the beets grown during 1906.

The Belle Fourche project, when completed, will irrigate about 100,000 acres of very fine land. The soil is of two classes, about one-half being a sandy loam, the other half being a heavy clay soil. The clay soil seems to have given the best results so far with sugar beets. The project is about half completed at this time, the first section being irrigated this year for the first time.

Very truly, yours,

R. F. WALTER, *Engineer in Charge.*

Test of sugar beets dug October 20, 1906, in Belle Fourche Valley, South Dakota.

	Per cent of sugar.
J. M. Eaton	17.1
B. Kemper	14.7
Jno. McClure	16.1
J. W. Haines	16.8
A. T. Adams	14.5
U. S. Reclamation Service	16.6
R. H. Evans	12.7

WASHINGTON.

ELLENSBURG.—For the past two or three years Ellensburg, near the headwaters of the Columbia River, in Kittitas Valley, has been under investigation by capitalists and business men with a view to establishing the sugar industry. The beets have shown high quality and good yield.

In regard to this locality, I submit the following letter from C. W. Adams, connected with the North Pacific Sugar Company, a local organization designed to promote the sugar industry in this locality:

SEATTLE, WASH., *February 26, 1908.*

DEAR SIR: The prospects for the construction of a beet-sugar factory at Ellensburg are favorable. For the years 1905–6, from 60 to 80 plats of one-eighth of an acre to an acre of sugar beets were planted, experimentally, in all sections of the Kittitas Valley. The quantity of beets per acre ranged from 10 to 20 tons, the sugar content from 12 to 20 per cent, and the purity from 81 to 92.

There is about 55,000 acres of tillable soil in the Kittitas Valley. The nature of the soil is loam. It is all irrigated or subirrigated. The elevation is about 1,200 feet, and the climate is perfect for the growth of all tubers. In all respects the locality is favorable for the beet-sugar industry.

Yours, truly, G. W. ADAMS.

OTHER PLACES.—Capitalists of Seattle and eastern points, in connection with local business men of North Yakima, have investigated beet-sugar production on the Columbia River. There is no place in the United States better adapted to the purpose. Some time in the near future a factory will be established at this place. Another large factory is being planned for the vicinity of Spokane.

WYOMING.

Wyoming has many valleys subject to irrigation, well adapted in quality of soil and natural conditions to the sugar industry. It has the fuel, both coal and oil. Natural conditions favorable to the sugar industry are much like those of Colorado and Montana. It needs transportation and development of irrigation facilities. The State is in its infancy in the development of its great resources. There are several places in the State considering the installation of the beet-sugar industry, the principal ones being Sheridan and Byron in the northern part of the State, and Wheatland in Laramie County in the southeastern part of the State, on the Chugwater River.

BYRON.—Byron is in one of the most fertile valleys of the West. It is located on the Big Horn River. In regard to local conditions and prospects for a sugar factory at this point, I submit a report by Byron Sessions, who has given considerable time and investigation to the subject:

BYRON, WYO., *February 27, 1908.*

DEAR SIR: We think we have the best land for the production of the sugar beet, with our perpetual sunshine, that there is in the United States.

The Shoshone River is the only river in the mountains, and its highest water comes in the month of July. This stream receives its supply almost wholly from the Yellowstone National Park, which is thoroughly protected from the ravages of man and beast.

The raising of sugar beets in the Big Horn Basin is no longer an experiment. We have been testing the beets for the last five years. In the year 1907 we grew at Lovell 321 acres of beets that would run over 15 tons per acre. These beets were shipped to the Billings sugar factory and showed an average of 18 per cent sugar, some going better than 20 per cent, and all better than 80 in purity.

We have plenty of water, good soil, and practically 365 days of sunshine. Our spring weather is such that we can get all our beets planted in April, thus giving them a good long season. We have no storms in the fall, only long warm sunny days and cool nights, which are ideal for putting the sugar into the beets.

The following are results of beet culture at Lovell in 1907:

Some results of sugar-beet growing at Lovell, Wyo., in 1907.

Name.	Acres.	Tons per acre.
J. M. Grant	52	14
Tippets Bros	40	16
A. A. Durfee	14	17
J. A. May	8	17½
R. Robertson	11	15
Allen Tracy	3½	18

The people of Lovell and Cowley have now contracted for 1,500 acres of beets for the Billings sugar factory for the year 1908.

We have at present lands that are thoroughly under control that have been irrigated, amounting to 8,000 acres, along the line of the Burlington and Missouri River Railroad, none of these lands being more than 3 miles from this road; 14,000 acres more that the canal is built upon near Lovell, which is situated on the line of the Burlington and Missouri River Railroad; and 30,000 acres that are now ready to have water turned upon it this coming April, at or near Garland, this county. The spur of the Burlington and Missouri River Railroad runs directly through this tract of land. The above tract is covered by canal through the Reclamation Service, with all of the laterals reaching each and every subdivision.

There are also at least 30,000 acres situated on the Greybull River, all of which is in alfalfa, only waiting the advent of the Burlington and Missouri River Railroad to put a line through this beautiful valley, which to my mind is the most fertile valley in the State of Wyoming.

Then there is what is known as the Shoshone River Canal and Oregon Basin Reservoir Irrigation Company. The canal is nearing completion and runs parallel with the Shoshone and Greybull rivers, having in all 150,000 acres of No. 1 land. In all there is at least 500,000 acres of land in this basin that is specially adapted for the culture of the sugar beets, and we are inviting capital to join with us in making this the greatest sugar-producing county in the United States.

Yours, respectfully,

BYRON SESSIONS.

WORK OF THE BUREAU OF PLANT INDUSTRY.

B. T. GALLOWAY, CHIEF.

OBJECT OF THE WORK.

The work covered by sugar-beet investigations of this Bureau embraces a study of the diseases, the cultural methods, the use of fertilizers, the development of special strains of beets—including beets resistant to alkali, beets suitable for semiarid sections, beets of large size and high sugar content—and the development of modified seeds, such as single-germ seed balls, etc. The work also includes the growing of commercial beet seed, which embraces methods of siloing, studies of types, analyses of roots, and methods of planting and harvesting. Efforts are also being made to find new localities where seed may be grown commercially for sugar. This work may be summed up under three general heads, namely, methods of increasing the sugar per acre, the production of American-grown seed, and the extension of the sugar-beet territory.

INCREASING THE SUGAR PER ACRE.

Efforts are being made to increase the yield of sugar per acre by increasing the size and quality of the beet and by improving the stand, so that the optimum number of beets per acre may be produced, care being used to give each beet the proper space for its best development. The principal factors affecting size, quality, and stand of beets are cultural methods, fertilizers, diseases, and special strains of beets.

CULTURAL METHODS.

The chief cultural methods under investigation are preparation of seed bed, which includes subsoiling, deep and shallow plowing, fall and spring plowing, summer fallowing, rotation of crops, width of rows, and deep, shallow, and late cultivation. Subsoil plowing seems to be advantageous if the subsoil is extremely hard; otherwise no results follow this extra expenditure of labor so far as our cooperative tests have shown. Deep plowing is advantageous if too much raw soil is not thrown up. The increased depth of plowing must be attained gradually. In general, shallow cultivation gives *better results* than deep cultivation; and the indications so far are